ALZAGHARI, OMAR, Ph.D. Factors Influencing 30-Day Unplanned Rehospitalization in Adults with Heart Failure: Data from an Urban Hospital in North Carolina. (2016) Directed by Dr. Debra C. Wallace. 132 pp.

**Background:** Heart failure (HF) patients have high rates of hospital readmission resulting in large human and financial costs to families, communities, hospitals and payers. Developing comprehensive interventions to decrease rates requires knowledge of the contextual, physiological, psychological and role function factors related to 30-day HF unplanned rehospitalization. **Objective:** The aim of the study was to assess the influence of contextual factors (patient's characteristics), physiological factors, psychological factors, and role function factors on 30-day HF unplanned rehospitalization. **Methods:** This cross-sectional study was guided by the Roy Adaptation Model, and Electronic Medical Record data (N = 270) were used. Chi square analyses and logistic regression were used to answer five research questions. **Results:** Findings revealed all factor types predicted 30-day HF unplanned rehospitalization, but in different levels. The contextual factors predicting 30-day HF unplanned rehospitalization were length of stay, previous hospitalizations, weight change between discharge and admission, and New York Heart Association Functional Classification (NYHA). Physiological factors were Chronic Kidney Disease, the use of Continuous Positive Airway Pressure machine (CPAP), B-type natriuretic peptide, and the use of Angiotensin Converting Enzymes Inhibitor medications. The psychological factor was the use of antidepressant, and the role function factor of being married were predictors of 30-day HF unplanned rehospitalization. **Conclusion:** Many factors must be considered to prevent 30-day HF unplanned rehospitalization. Nurses should plan a variety of

interventions that promote individuals' health and improve health outcomes to reduce 30-day HF unplanned rehospitalization.

*Keywords:* Heart failure, 30-day HF unplanned rehospitalization, contextual factors, physiological factors, psychological factors, and role function factors.

# FACTORS INFLUENCING 30-DAY UNPLANNED REHOSPITALIZATION IN ADULTS WITH HEART FAILURE: DATA FROM AN URBAN HOSPITAL IN NORTH CAROLINA

by

Omar Alzaghari

A Dissertation Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Greensboro
2016

Approved by

_____
Committee Chair

In loving memory of my mother Sarah Alzaghari. You are so loved and missed.

To my beloved and supportive father Mohammad Alzaghari. Thank you for the prayers.

To my wonderful wife Lana Zaghari for her endless love and support throughout my PhD program. Without you none of this would have happened.

To my children Tala, Anas, and Zaid. I love you all so much!

To my father-in-law Saleh and mother-in-law Fatima. Thank you!

APPROVAL PAGE

This dissertation written by OMAR ALZAGHARI has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Chair

_____
Debra C. Wallace

Committee Members

_____
Margaret Savoca

_____
Robin Bartlett

_____
Yolanda Hyde

_____
Date of Acceptance by Committee

_____
Date of Final Oral Examination

# ACKNOWLEDGEMENTS

I would like to thank my dissertation chair, Dr. Debra Wallace, for supporting and guiding me during these past five years. Dr. Wallace is an expert in the field of cardiac research, and she preeminent in the field. Dr. Wallace guided me in selecting the research design, statistical analyses, and research methodology. She has been a phenomenal support throughout this program, and she is the reason why I am here today.

I also have to thank the members of my dissertation committee for their expertise, insightful discussions, and guidance throughout my educational journey in the PhD program. I would like to thank Dr. Margaret Savoca, Dr. Robin Bartlett, and Dr. Yolanda Hyde for their helpful advices, and suggestions.

I would like to extend my sincerest thanks to Dr. Susan Letvak for being a great support throughout my journey in the PhD program, and for her career advice. Dr. Letvak has been helpful in providing advice many times during my PhD program. She was and continues to be my role model as a mentor and educator.

I would like to thank my siblings (Shadi, Mahmoud, Lara, Mostafa, Zaid and Jafar), Alzaghari family all over the world, my friends, colleagues, and coworkers for their support and guidance throughout my educational journey.

Finally, I would like to acknowledge and thank Dr. Kim Frazier and Dana Crston for their support and help throughout the dissertation process, data collection, and data entry. In addition, I would like to give a special acknowledgment to my classmates for being a part in my educational journey, and for their support and guidance throughout the course of my study.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

# CHAPTER I

# INTRODUCTION

For the past two decades, the interest in reducing the rates of Heart Failure (HF) unplanned rehospitalization continues to be a top priority for the government and health care systems. Nevertheless, the results of different studies and interventions targeted to this phenomenon have been contradictory. The prevalence and incidence of HF have been increasing, as well as 30-day HF unplanned rehospitalizations rate. In 2010, HF was the main cause for mortality in a sample of 58,000 patients (Go et al., 2014). Moreover, estimates show that approximately 800,000 patients have been diagnosed with HF every year (Go et al., 2014). In this study, the Principal Investigator (PI) assessed the influence of contextual factors (patient's characteristics), physiological factors, psychological factors, and role function factors on 30-day unplanned rehospitalization in HF patients. The need for identifying those factors was considered an important key to develop a basis for tailored interventions addressing the amenable factors that would decrease 30-day HF unplanned rehospitalization. Also, findings provide knowledge on which to develop successful discharge plans that focus on specific patients' needs and reduce the unnecessary expenditures associated with 30-day HF unplanned rehospitalization.

## Background and Significance

The evaluation of the factors associated with 30-day unplanned rehospitalization in patients with HF has been imperative. It supports the process for designing tailored

interventions, to improve patient's outcomes and improve the overall quality of care (Eastwood et al., 2014). Ultimately, this knowledge assists health care systems and providers with a focus on minimizing health care expenditures associated with HF, reducing hospital length of stay, providing high quality of care, relieving patients' pain, safely discharging patients, and minimizing unplanned rehospitalizations.

The significant growth in the rates of HF unplanned rehospitalizations has been a source of difficulties not only for patients but for families, health care providers and health care systems, demanding human and financial costs to achieve the best patient outcomes possible (Giamouzis et al., 2011; Go et al., 2014). During the past few decades, the number of HF patients' visits to the emergency department (ED) significantly increased, despite improvement in the management of this chronic condition. A recent study by Hasegawa, Tsugawa, Camargo, and Brown (2014) examined the number of emergency department visits for a group of HF patients in two major states (Florida and California). The report showed that closer to 31% of the total number of participants in this study scored more than 175,000 visits to the ED within the first year after discharge, which represented a significant number of visits. Consequently, the increase in the number of ED visits increased chances for HF rehospitalization in most cases. Thus, the findings showed that those interventions to prevent HF readmissions were not yielding the preferred outcome.

Families, insurance companies, employers, the health care community and agencies expend a considerable amount of money to provide care for this population. This has resulted in an increased financial burden on the government, which

pays/reimburses providers and health care systems (Go et al., 2014). The costs of HF readmissions includes not only the cost of actual care associated with HF during these hospital stays, but the cost of treating any other diseases or conditions, such as, diabetes that may afflict the patient, too (Copeland, Berg, Johnson, & Bauer, 2010; Whellan, Greiner, Schulman, & Curtis, 2010). Further, the cost to families and communities may be decreased quality of life, lost productivity, and increased caregiving responsibilities and needs. The financial burdens associated with HF include the direct cost of medical care as well as the expenses associated when rehospitalization occur. Areas of suggested study include the patient, the health care provider, and caregiver, in addition to, the predictors of readmission for HF patients (Coby, Marie-Louise, & Tiny, 2009).

Generally, research in HF has included the etiology and pathophysiology, contributing factors, treatment modalities, HF exacerbation, and interventions that reduce exacerbation, and HF rehospitalization prevention. In addition, areas of study include contextual factors such as patient characteristics, communication between health care provider and HF patients, and the level of family and caregiver involvement in the process of HF care (Coby et al., 2009).

## Purpose Statement

The aim of the study was to assess the influence of contextual factors (patient's characteristics), physiological factors, psychological factors, and role function factors on 30-day HF unplanned rehospitalization in a sample drawn from a hospital in small urban area of North Carolina.

## HF Definition

The Heart Failure Society of America has made significant efforts to define the phenomenon of HF (Lindenfeld et al., 2010), and in their report, HF was defined as:

> A syndrome caused by cardiac dysfunction, generally resulting from myocardial muscle dysfunction or loss and characterized by either left ventricular dilation or hypertrophy or both. Whether the dysfunction is primarily systolic, diastolic, or mixed, it leads to neurohormonal and circulatory abnormalities, usually resulting in characteristic symptoms such as fluid retention, shortness of breath, and fatigue, especially on exertion. In the absence of appropriate therapeutic intervention, HF is usually progressive at the level of both cardiac function and clinical symptoms. The severity of clinical symptoms may vary substantially during the course of the disease process and may not correlate with changes in underlying cardiac function. Although HF is progressive and often fatal, patients can be stabilized and myocardial dysfunction and remodeling may improve, either spontaneously or because of therapy. In physiologic terms, HF is a syndrome characterized by either or both pulmonary and systemic venous congestion and/or inadequate peripheral oxygen delivery, at rest or during stress, caused by cardiac dysfunction (p. 480).

HF is a syndrome where the heart is unable to maintain cardiac output, which leads to a lack of oxygen supply to organs, resulting in a failure to meet the metabolic demands for these organs. The symptoms associated with HF depend on which organ has a lower blood supply, and the extent of the resulting lack of oxygenation. The majority of HF patients exhibit symptoms of fluid retention which is called congestive heart failure (CHF) (Copstead & Banasik, 2005). Currently, HF has no cure, so the available treatment modalities aim to alleviate the symptoms associated with heart failure, prevent deterioration, and improve quality of life.

HF is classified based on the severity of the symptoms; the most widely used classification is the New York Heart Association (NYHA) Functional Classification. HF is classified into four major categories:

1) Class I: No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea (shortness of breath).
2) Class II: Slight limitation of physical activity. Comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea (shortness of breath).
3) Class III: Marked limitation of physical activity. Comfortable at rest. Less than ordinary activity causes fatigue, palpitation, or dyspnea.
4) Class IV: Unable to carry on any physical activity without discomfort. Symptoms of heart failure at rest. If any physical activity is undertaken, discomfort increases.

HF is best explained as being the final point following specific cardiac disorders, such as, high blood pressure, coronary artery disease, valve disease, repeated myocardial infarction; or chronic non-cardiac disorders such as, diabetes (Go et al., 2014). It greatly affects the person's ability to care for themselves, often referred to as HF self-care (D. K. Moser et al., 2012). Heart failure is linked to higher rates of mortality and morbidity, and those rates are significantly influenced by the exacerbation of HF symptoms, such as increases in shortness of breath experienced with physical exertion (Barsheshet et al., 2010). HF contributes to and compounds other illnesses that often result in a significant increase in health care spending, and unplanned rehospitalizations (Esposito, Bagchi, Verdier, Bencio, & Kim, 2009). Therefore, the early detection and treatment of HF is

crucial to lower both morbidity and mortality rates, as well as, HF care expenditures (Manzano, Escobar, Cleland, & Flather, 2012).

HF is a major condition that can occur at any stage of an individual's life, though older adults (>65 years) are at higher risk for having cardiac related disorders, such as, HF because of the physiological and functional changes with aging. The literature suggests that individuals 65 years and older represent more than two thirds of the total population with HF in the United States (Chiung-Zuan & Jun-Jack, 2007). Specifically, the prevalence of HF is found to be higher after the age of eighty (Carmen Van Voorhis & Morgan., 2007).

## Etiology of HF

Different disorders or conditions can lead to HF. These disorders are classified under two major categories: Ischemic cardiomyopathies and non-ischemic cardiomyopathies. The most frequent condition is the ischemic cardiomyopathies such as myocardial infarction and hypertension. The non-ischemic cardiomyopathies, which include dilated cardiomyopathy, inherited heart disorders, respiratory disorder, anemia and hyperthyroidism conditions, were found to be less common (Copstead & Banasik, 2005).

Most often HF results because of: 1) the inability of heart fibers to contract, which is referred to as systolic HF, or 2) the inability of heart fibers to relax, which is called diastolic HF, or 3) the combination of both (Copstead & Banasik, 2005). The taxonomy of HF into systolic and diastolic is built on the value of the left ventricular ejection fraction (EF). Normally, the value of EF is between 60-80%. The systolic HF is

characterized by an ejection fraction below 40%, whereas diastolic HF is characterized by normal (>40%) or close to normal EF. Overall, HF results due to significant damage to the heart muscles, and such damage is considered irreversible. The damage to the heart muscles, and the associated dysfunction, occur because of preceding cardiac diseases, such as, hypertension and myocardial infarction.

## Condition Indicators

In most cases, HF symptoms are not specific, which has made the diagnosis of HF challenging. The major symptoms of HF exacerbation are dyspnea, fatigue, edema (localized or generalized), and a lower level of motor activities. The major signs of HF include muscle wasting, tachycardia, wheezing, irregular heart sounds, elevated jugular venous pressure, ascites and enlarged liver (Watson, Gibbs, & Lip, 2000).

Dyspnea is one of the common symptoms associated with heart failure. This symptom results from fluid overload in both lungs to the extent that lungs are unable to expand, and is moderately used to assess the incidence of HF. Dyspnea is not definitive or specific only to HF and may be due to some types of respiratory disorder. Fatigue is considered a symptom of HF, which usually results because of the lack of oxygen supply and lack of blood flow to different muscles, mainly the skeletal muscles. This lack of oxygenation will lead to major alteration in the structure and elasticity of the muscles, consequently causing severe damage to the muscles and, thus, fatigue. Edema is one of the most common HF symptoms, and one that is easy for the patient to recognize. Usually edema is located around the ankles and feet, but can be in other parts of the body, such as the abdomen. Typically, edema occurs because of right-sided HF. This type of

failure causes pain to the right side of the abdomen due to liver enlargement and abdominal distension. The weight increase in HF patients is mainly associated with edema; therefore monitoring body weight is considered as a valid indicator to determine the effectiveness of HF treatment (Watson et al., 2000).

The signs of HF exacerbation include tachycardia, jugular vein distention, and irregular heart sound, mainly S3 (the displaced apex beat). Tachycardia (acceleration in heart rate) is one of the signs for HF exacerbation, although not specific. Tachycardia is a premature sign that the heart is working harder to meet the metabolic demands of other organs. One of the major signs of HF in patients with history of cardiovascular disease is jugular venous distention; this sign is considered a strong indicator for the presence of HF that can be recognized easily during a physical examination. Unless HF was not caused by a preceding cardiovascular disorder, then this sign becomes less valid (Watson et al., 2000). Finally, the presence of abnormal sounds with heart auscultation, mainly S3, is believed to be associated with HF. Often recognition of this sign is limited to experiences professionals, and thus is not a common finding in primary care.

## Prevalence and Incidence

Over the past three decades, a major development has been noticed in the area of HF diagnosis and treatment, with a significant increase in the use of evidence-based practices. This revolution resulted in serious improvements in health outcomes, as evidenced by significant decreases in mortality and improved quality of life. However, the prevalence of HF in the United States and across the globe is significantly continuing to trend upward. In 2010, HF was considered the primary cause for mortality in a sample

of 58,000 elderly patients (Go et al., 2014). Moreover, it has been estimated that more than 800,000 patients are being diagnosed with HF every year. Data from the National Health and Nutrition Examination Survey (NHANES) (2007-2010) showed that more than five million patients age 20 years and older have been diagnosed with HF (Go et al., 2014). It has been anticipated that there will be an increase in the numbers of patients with HF, up to 46% for the period of 2012 to 2030, which represent a new 8 million HF patients who are 18 years and older (Heidenreich et al., 2013) for which to provide care and support.

Reports from the Framingham Heart Study have showed that HF incidence reaches a level of 10 per 1000 after the age of 65 years. The report stated that after the age of 40, the lifetime risk for developing HF in males and females was around 20 percent, though the life time risk for individuals who have blood pressures higher than 160/100 mm Hg was double that of an individual with blood pressures less than 140/90 mm Hg (Lloyd-Jones et al., 2002). The Multi-Ethnic Study of Atherosclerosis results showed that African Americans had the highest level for developing HF (4.6 per 1000), followed by Hispanic (3.5 per 1000), white (2.4 per 1000), and Chinese Americans (1.0 per 1000). Moreover, the higher risk for HF in African Americans was caused by the higher prevalence of hypertension and diabetes in that group (Bahrami et al., 2008).

The analysis of data from four different United States communities for the period between 1987 to 2002 showed that the age adjusted incidences of HF in white women was 3.4 per 1000, which is considerably lower than the rates of white men (6.0 per 1000), black women (8.1 per 1000), and black men (9.1 per 1000). Again, the higher rates of HF

in African Americans were linked to the higher number of cardiovascular risk factors associated with HF in that population, such as, hypertension (Loehr, Rosamond, Chang, Folsom, & Chambless, 2008).

As previously mentioned, the cost of hospital admissions related to HF has increased significantly over the past few decades. The increase in costs has been compounded due to the presence of multiple comorbidities, including, hypertension, atrial fibrillation, and coronary artery disease (Esposito et al., 2009). The patient often has one or more of those afflictions in addition to HF, which can lead to an increased number of visits to hospitals' emergency departments. A higher level of ED visits can increase their chances of being admitted to the hospital (Esposito et al., 2009). In 2009, it was estimated that one million patients with HF were admitted to hospitals across the United States; with a total cost of 34 billion dollars for these admissions (Britz and Dunn, 2010). In 2012, the cost was reduced to 30.7 billion, but still considered high when taking into consideration all the costs associated with providing different interventions (Go et al., 2014). In 2012, the costs for HF care represented more than 65% of the total health care costs for the entire year, and it is expected that the direct medical cost of HF care and associated treatment will double by 2030 ( $70 billion), or roughly about $250 for every resident of the United States (Heidenreich Pa et al., 2013).

## HF Unplanned Rehospitalization

HF has been found as the most common cause for rehospitalizations in adults that influences all areas of life, such as physical, physiological, and psychological aspects of life (Go et al., 2014; Vasiliki et al., 2010). HF readmission refers to the patient's

admission to a hospital within a certain number of days (7, 30, 90,180, and 360) after discharge with the same diagnosis (HF). The rates of HF unplanned rehospitalizations continue to increase, with little modification and reduction to those rates (Ross et al., 2010). In general, the literature suggests that the rates of HF readmission are trending upward at 7-day, 30-day, 60-90 day and 180-day, with an increase by 5.6%,16%-25%, 30% and 45% respectively (Eastwood et al., 2014; Gregg C. Fonarow et al., 2007; Jencks, Williams, & Coleman, 2009; Keenan et al., 2008; H. M. Krumholz et al., 1997; Ross et al., 2010). In some studies, rehospitalizations included more than half of the total patients discharged with HF (Joynt & Jha, 2011; Harlan M. Krumholz et al., 2009; Setoguchi & Stevenson, 2009). Similarly, older adults with HF have higher risks for readmissions with minimal reduction regardless of the different interventions that have targeted this population (Ross et al., 2010). The latest statistics for older adults aged 65 and older and have Medicare as their primary insurance has revealed that the average number of HF readmissions had not changed in the past few years, indicating a lack of reduction in these readmission rates (Ross et al., 2010). Therefore, the focus on this phenomenon became a top priority to the government, health care providers, payers, families and communities.

As the rates of unplanned rehospitalizations in HF patients increase, the cost of the associated treatment increases significantly. In response to these increases, the Center for Medicare and Medicaid Services (CMS) has decided to stop reimbursement for avoidable readmission occurring within thirty days after discharge (Centers for Medicare & Medicaid Services, 2014). Also, CMS has a plan to penalize hospitals with higher rates

of readmissions and provide incentives for the hospitals with lower rates of readmissions. The new policies and guidelines by CMS provide new challenges for health care systems and providers, forcing them to find strategies to reduce or eliminate HF 30-day unplanned rehospitalizations (Centers for Medicare & Medicaid Services, 2014).

## Factors that Influence HF Unplanned Rehospitalization

Multiple factors influence HF unplanned rehospitalizations. Commonly, a fair number of rehospitalizations related to HF can be prevented by early detection of the signs and symptoms of exacerbation events, recognizing the predisposing factors, and engagement in self-management behaviors (D. Moser & Mann, 2002). The contributing factors for HF readmission include but are not limited to: 1) Patients' non-compliance with prescribed medications, cardiac healthy diet, and fluid restrictions; 2) Patients' non-compliance to the treatments prescribed by health care providers for different cardiac and non-cardiac risk factors, such as, hypertension and diabetes; 3) Poor management for cardiac arrhythmias associated with HF; 4) Higher doses of selected medications, such as, negative inotropic agents; 5) Pulmonary embolism; 6) Higher doses of nonsteroidal anti-inflammatory drug (NSAID), and 7) Endocrine irregularity and different types of infections (Hunt et al., 2009). In addition, there have been distinct factors that influence HF readmission within 30-days after hospital discharge, such as, episodes of edema (fluid retention), higher creatinine level and lower systolic blood pressure (Muzzarelli et al., 2010). Heart failure rehospitalization within 90 days significantly increased in patients with a co-diagnosis of coronary artery disease (CAD). Similarly, the risk for HF rehospitalization increased significantly with the presence of an implanted

pacemaker/defibrillator device, high jugular venous pressure, aging, and depressive symptoms (Muzzarelli et al., 2010). Moreover, diabetes mellitus and the number of previous hospitalizations were found to raise the chance for HF rehospitalization (Corrao, Ghirardi, Ibrahim, Merlino, & Maggioni, 2015; Vasiliki et al., 2010). Finally, depression and the associated symptoms have been related to increased HF rehospitalization rates in adults (Song, Lennie, & Moser, 2009).

## Conceptual Framework

The conceptual framework for this study is based on the Roy Adaption Model (RAM). The root of the adaption model started in 1964, when Sister Callista Roy as a graduate student started to develop a model to guide nursing practices (Masters, 2012). The first version of her model was published in 1970 as an article called "Adaptation: a conceptual framework for nursing." In 1991, the final and refined version of Roy's model was completed. Now, the RAM has been adopted broadly to guide nursing research and practice all over the world. The model is used in other health care fields (Andrews & Roy, 1991).

Roy's model has inspired authors to write books about the concept of adaptation in nursing science (Lutjens, 1991; Rambo, 1984; Randell, Tedrow, & Van Landingham, 1982; Seo-Cho, 1999). It helped in the process of expanding nursing knowledge by guiding research in health care setting and nursing education. The RAM was applied to multiple populations with different characteristics and backgrounds (Masters, 2012). The model has been widely used in health care, mainly for examining health status and the adaption in stressful situations such as cancer (P. Henderson, 2003; Poirier, 2007;

Ramini, Brown, & Buckner, 2008; Samarel, Tulman, & Fawcett, 2002; Tulman, Fawcett, & McEvoy, 1991; Zeigler, Smith, & Fawcett, 2004), chronic obstructive pulmonary disease and HF (Akyil & Ergüney, 2013; Bakan & Akyol, 2008; Tsai, Tak, Moore, & Palencia, 2003; Whittemore & Roy, 2002), end of life issues (Dobratz, 2011), pregnancy and postpartum issues (Isbir & Mete, 2010; Pollock, Amankwaa, & Amankwaa, 2005; Posmontier, 2008) , AIDS (Perrett & Biley, 2013; Phillips, 2011; Waweru, Reynolds, & Buckner, 2008), and caregiver issues (Levesque, Ricard, Ducharme, Duquette, & Bonin, 1998).

The model considers an individual as a bio-psycho-social-spiritual element, and emphasized on the importance of the balance between those elements. The RAM looks at the individual holistically, and addresses several aspect of human being study.

The RAM emphasizes the importance of providing nursing care for different populations from different cultures. The individual is considered an adaptive structure that continuously adjusts to different environmental stimuli both internal and external (Masters, 2012). Usually, the surrounding environment is the main foundation for different stimuli, which may improve or jeopardize the total human structure, thus increasing their adaptation or leading to maladaptation. Roy classified the stimuli into three major categories:  Focal stimuli are classified into internal and external variables that directly influence the adaption of human structure, and draw the individual's attention to adapt. Contextual stimuli are defined as further stimuli that boost the influence of focal stimuli. Residual stimuli are defined as all other phenomena that rise from the individual's surrounding either internally or externally and influence the focal

stimuli. The adaptation level is defined as the different types of stimuli influencing the individual's structure and triggering their adaptation mechanism to maintain a healthy level of adaption (Andrews & Roy, 1991).

Adaptation as defined by Roy is "the process and outcome whereby thinking and feeling persons as individuals or groups or in groups, use conscious awareness and choices to create human and environmental integrity" (Roy & Andrews, 1999, p. 54). Roy proposed two coping mechanisms that occur as consequence to different stimuli. The first mechanism is called regulator, which include the response to stimuli through, nervous, endocrine, and chemical mechanisms. The stimuli send signals through different channels that will activate certain mechanisms and lead to change in electrolytes and fluid status in the human body. The second mechanism is called cognator that include the response to stimuli through cognitive and emotional process (Andrews & Roy, 1991). To measure coping mechanism, Roy proposed that these mechanisms including both regulator and cognator could be measured through behaviors of human beings exhibited after any exposure to different types of stimuli. Roy further explained that the human as an adaptive structure displays different types of behaviors in response to stimuli; Roy called them "adaptive modes." These modes include physiologic-physical, self-concept-group identity, role function, and interdependence mode. Roy indicated that adaptation occur as a result to the interaction between those modes and different environmental stimuli (Roy & Andrews, 1999).

Roy's adaption model has a variety of assumptions; those assumptions are categorized under three major areas: philosophical, scientific, and cultural. The

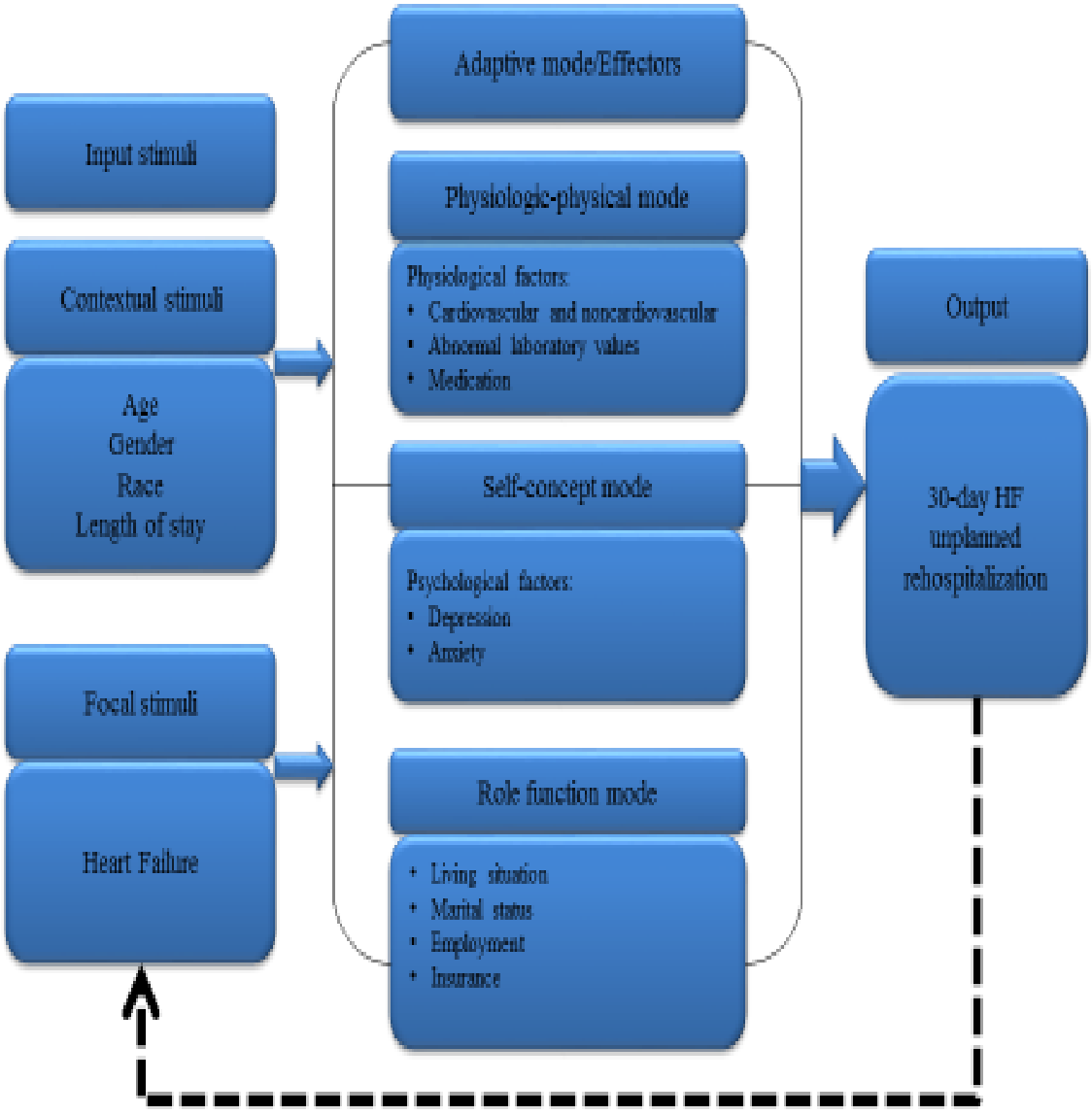
philosophical category included: a) the association between an individual and environment, in addition, the association with god; b) human significance is imbedded in an omega point merging the universe; c) god is discovered in the multiplicity of creation and is the endpoint for all creation; and d) humans are accountable for the process of arising, supporting, and converting the world (Roy, 2008). The scientific assumptions include: a) systems of matter and energy advance with time to more complicated level of self-organization, b) consciousness and meaning result because of the assimilation between human and the environment, c) self-awareness and environmental awareness ingrained feeling and thinking, d) thinking and feeling reconciles human activities, e) human and globe have common pattern and f) the interaction of human and atmosphere create adaptation (Roy, 2008). The cultural assumptions include: the RAM is sensitive to how each person perceived the element of RAM in their culture, the main concept in the RAM is the one that is most important to the culture. the cultural influence might influence nursing practice mainly for practices that adopt RAM, and based on the practiced culture in an area, the use of the RAM in research might vary taking into account the culture (Roy, 2008).

The RAM has three components that were used in this study: Input/stimuli (internal and external); Effectors/ adaptive mode (promote or threaten the adaption level); and Output/adaptive response (see Figure 1). Different studies have utilized the RAM to show that human beings are considered coping units. In general, beings adapt to the presence of environmental stimuli (input). Then effectors (adaptive mode) are used to adjust to a stimuli and provide, when individual lack adaption to certain stimuli, a loop

and feedback as a stimuli in that model. The model was used to assess the influence of contextual factors of patient's characteristics, physiological factors, psychological factors, and role function factors (socioeconomic status) on 30-day HF unplanned rehospitalization. In the conceptual model for this study, it was hypothesize that there was an association between different stimuli, for example, the patient's characteristics, physiological factors, psychological factors, and role function and the adaptive response (effective or ineffective) in HF patients see Figure (1). By examining the relationship between stimuli and 30-day HF unplanned rehospitalizations, a better understanding of the HF patients at higher risk for rehospitalization in this population was developed.

Figure (1) The Roy Adaptation Model.

Figure 1. Roy Adaptation Model




For the purpose of this study, HF patient was considered an adaptive system. The patient with HF encounters a variety of stressors during the life span. However, over the period of HF hospitalization, patients were exposed to numerous stressors, including, length of stay, pharmacological treatment, the presence of comorbidities, and changes in

lab results that influenced the level of patient's adaption (spend more or less time at the hospital). The degree of adaptation, unplanned rehospitalization, was measured by the level of adjustment and maladjustment to these stressors.

As Roy suggested, nurses are encouraged to expand the adaptation zone for patients with chronic conditions such as HF. In addition, nurses need to help patient adapt to stressors. In general, HF patients show a significant maladaptation to stimuli that might occur before, during and after hospitalization, and because HF is a condition that requires major consumption of health care services, successful adaption is preferred to increase the effectiveness of adaptive response, consequently decrease the rates of 30-day HF unplanned rehospitalization, and improve quality of life.

The concepts under RAM were identified as the following: HF as a chronic condition was considered the focal stimulus, which threatened the adaptation of human structures during hospitalizations and after discharge. The contextual stimuli were the patient characteristics, such as age, gender, and race, which should have boosted the influence of HF on patient's level of adaptation during hospitalizations, and decreased their risk for 30-day unplanned rehospitalization after discharge. Finally, the residual stimuli were defined as all other unknown variables excluding focal and contextual that might have influence on the adaption level of HF patients during hospitalizations and might influence 30-day unplanned rehospitalization after discharge.

The RAM proposed four different adaptation modes and three were used in this study. The physiological-physical mode included the physiological activity of cells, tissue, organs, and the system inside human being. This mode focused on the stability of

the acid-base, endocrine, and neurological functions inside the individual (Roy, 2008). The physiological-physical mode in this study was operationalized as the general health status of the HF patient during hospitalization and was measured by the stability of the physiological status including, the presence of cardiovascular or non-cardiovascular conditions, the laboratory values (normal of abnormal), and the use of cardiac related medications. The second mode was the self-concept mode. This mode included the psychological aspect of human being, self-image, self-consistency, and spiritual belief system (Roy, 2008). In the proposed study, this mode was operationalized by general psychological conditions that could have influenced self-image and the patient's psychological status during hospitalization, such as, depression and anxiety. The third mode of adaptation was the role function mode, operationalized as the role of a person in the society and how individuals' roles influenced their level of adaption (Roy, 2008). In this study, the roles were measured by patient's living situation, marital status, insurance, and employment status of the HF patients. Finally, unplanned rehospitalization within 30-day was considered maladaptation of HF patient after discharge. Thus, maladaptation to stimuli from different origins in HF patients increased the chances for unplanned rehospitalization. By focusing on the balance between different types of stimuli, HF as chronic condition, and the environment, the RAM was very useful to guide this study examining of 30-day unplanned rehospitalization in HF patients.

## Research Questions

Are contextual stimuli (patient's characteristics, such as, age, gender, race, length of stay, residency area, BMI (body mass index), number of previous hospitalizations,

difference in weight between discharge and admission, and the New York Heart Association Functional Classification) associated with 30-day unplanned rehospitalization in adults with heart failure?

What physiological factors are associated with 30-day unplanned rehospitalization after adjusting for age in adults with heart failure?

a) Which cardiovascular and non-cardiovascular conditions is associated with 30-day unplanned rehospitalization after adjusting for age in adults with heart failure?
b) Which laboratory values (normal or abnormal) are associated with 30-day unplanned rehospitalization after adjusting for age in adults with heart failure?
c) Which type of cardiac related medication is associated with 30-day unplanned rehospitalization in adults with HF patients?

Are psychological factors, such as, the diagnosis of depression and anxiety associated with 30-day unplanned rehospitalization after adjusting for age in adults with heart failure?

Are role function factors, such as the patient's living situation, marital status, insurance, and employment status associated with 30-day unplanned rehospitalization in adults with heart failure?

Are the combined contextual factors of patients' characteristics, physiological factors, psychological factors, and role function mode associated with 30-day unplanned rehospitalization in adults with heart failure?

## Definition of Terms

*Heart Failure (Theoretical):* is "the end stage of a cardiac disease, it is most often a consequence of hypertension, coronary heart disease, valve deformity, diabetes, or cardiomyopathy" (Rosamond et al., 2008, p. e87).

*Heart Failure (Operational):* a patient with HF will be defined a patient who is 21 years and older with a medical diagnosis of heart failure.

*Hospitalization (Theoretical):* as defined in the dictionary is "the act or an instance of being hospitalized"("hospitalization ", 2014).

*Hospitalization (operational):* The length of admission HF patients spends in the hospital under inpatient status.

*Unplanned Rehospitalization (Theoretical):* It is defined as the readmission to the hospital with a primary diagnosis of HF within 30-days after being discharged.

*Discharge period (Operational):* is defined as the time from being released from the hospital (the point when HF patient has left the hospital) and up to 30 consecutive days after the release.

*Physiological factors (Theoretical):* as defined in the dictionary as "characteristic of or appropriate to an organism's healthy or normal functioning."("Physiological," 2014). Or it is defined as: The functions and properties of living organisms, including both the physical and chemical factors and processes, supporting life in single- or multi-cell organisms from their origin through the progression of life (Pubmed, 2014a).

*Physiological factors (Operational):* For the purpose of this study, physiological factors were defined as the cardiovascular and non-cardiovascular condition related to

heart failure, laboratory values (normal or abnormal) during hospital stay, and the type of cardiac related medication that HF patients are taking.

*Psychological factors (Theoretical):* "Mechanisms and underlying psychological principles of mental processes and their applications."(Pubmed, 2014b)

*Psychological factors (operational):* For the purpose of this study, psychological factors was defined as the presence of mental conditions that might influence 30-day unplanned rehospitalization in HF patients.

*Role function (Theoretical):* "the role function focuses on the roles of the person in society and within a group." (Roy, 2008, p. 49)

*Role function (operational):* For the purpose of this study role, function was defined as by the current living status of HF patient, the marital status (married/not married), employment status (employed/unemployed), and the insurance status (insured/uninsured).

## Summary

Heart failure is a chronic condition with high incidence, prevalence, and 30-day unplanned rehospitalizations. The interest in reducing the rates of HF 30-day unplanned rehospitalization continues to be a top priority for the government, health care systems, payers, families and communities. However, results of previous studies and interventions targeting this phenomenon have not been consistent in producing the outcomes desired. Identifying different factors that influence 30-day unplanned rehospitalization in HF was the focus of this study to provide a basis for developing tailored interventions and a successful discharge plan that focuses on specific patients' needs. The Roy Adaptation

Model was used to guide the study. Focal, contextual and residual stimuli were included and three modes of adaptation were used. In this study, the PI assessed the relation of contextual factors (patient characteristics), physiological factors, psychological factors, and role function factors on 30-day unplanned rehospitalization in HF patients. This study was developed because of the increased interest in reducing 30-day unplanned rehospitalizations among HF patients in compliance with the current CMS guidelines.

# CHAPTER II

# LITERATURE REVIEW

Unplanned rehospitalization refers to patients' admission to a hospital because of the same diagnosis within certain amount of days (usually between 7-30 days). It is different from planned rehospitalization, which usually arranged by a health care provider, for example, a patient admitted for a cardiac catheterization. Based on the result of the procedure; the physician would ask the patient to come back for further evaluation, or an intervention, such as pacemaker placement. Previous scientific literature has identified different factors linked to increased chance for HF rehospitalization. Identifying HF patients at higher risk for rehospitalization is crucial and beneficial in the process of developing screening tools, and HF specific interventions. Mihai Gheorghiade, Vaduganathan, Fonarow, and Bonow (2013) suggested that in order for health care systems to develop efficient approaches in addressing and decreasing the chances for HF unplanned rehospitalization, they need to : 1) follow what is called "mechanistic approach" to identify the most likely conditions that increase the chances for HF rehospitalizations, and develop tailored interventions to treat these conditions. 2) Implement treatment modalities in clinical practice, in addition to, a variety of disease management programs that were developed based on evidence-based practice and compatible with the current treatment guidelines. 3) Focus on assessing and managing the non-cardiac morbidities, such as diabetes. Moreover, assess the need for patient's

transition to home with home health services or to a skilled facility, emphasize on follow up, and continue to monitor patients after discharge.

The factors that influence HF unplanned rehospitalization include patient's characteristics, physiological factors, psychological factors, and socioeconomic status. The literature suggests different classification to those predictors. However, for the purpose of the study these factors were selected because of their main role influencing HF 30-day unplanned rehospitalization.

## Patient Characteristics

These factors were identified as booster to the influence of HF as a disease and a condition that puts pressure on patient's capability to adapt (live healthy life as much as possible), or encounter maladaptation (rehospitalization within 30-day). These factors included, age, gender, race, length of stay, residency area, BMI, number of previous hospitalizations, difference in weight between discharge and admission, and the New York Heart Association Functional Classification.

The rates for unplanned rehospitalization heighten significantly with age. The age of an individual with HF was found to be significant predictor for 30-days HF readmission (Corrao et al., 2015; Ogah et al., 2014; Prasun, Verhulst, Weller-Summers, Baur, & Nallamothu, 2013). Kossovsky et al. (2000) noted that the odds ratio for readmission risk increased to 3.3 and 4.1 for the HF patients in the study aged 65-79 year and >80, respectively. In addition, the HF readmission rates were anticipated to increase by 24% every decade of life (Toshimi Koitabashi et al., 2005). Moreover, aging was

found to be an antecedent for HF readmission in both Asian and African American population (R. Lee et al., 2009; Shinagawa et al., 2008).

Patient's gender has been identified as a determinant for HF rehospitalization. Male gender was linked to higher percentages of HF rehospitalization in several studies (Alla et al., 2007; Blackledge, Newton, & Squire, 2003; Toshimi Koitabashi et al., 2005; H. M. Krumholz et al., 1997). Numerous studies have shown that female gender is associated with higher percentages of HF readmission (Frazier et al., 2007; Howie-Esquivel & Dracup, 2007; Ingrassia, Soucier, Woiciechowski, Cyr, & Crowell, 2015; Mielniczuk et al., 2008; Opasich et al., 2004). While the result of different reports about the influence of gender on HF readmission were contradictory, there are studies that have revealed that gender was not linked to either an increase or a decrease in the chances for HF rehospitalization (W. Y. Lee, Capra, Jensvold, Gurwitz, & Go, 2004; Sheppard, Behlouli, Richard, & Pilote, 2005; Vaccarino, Chen, Wang, Radford, & Krumholz, 1999).

Race was considered to influence HF rehospitalizations. The analysis of several studies that examined the effect of race on rehospitalization rates among individuals with chronic conditions, such as, HF found that an individual's race is an important factor that contributes to increased risk for readmissions (Curtis et al., 2008; Fátima, Karen, Lenny, Fidencio, & Ashish, 2011; Friedman & Basu, 2004). Yet, other studies revealed no association between race and HF readmission (Agoston et al., 2004; Blackledge et al., 2003; Gambassi et al., 2008). Two studies by R. Lee et al. (2009) and Howie-Esquivel and Dracup (2007) illustrated that certain racial groups, such as, African Americans have

a higher likelihood to be rehospitalized compared to whites. Both groups of African Americans and Hispanics were at greater risk to be rehospitalized than Whites and Asians (Afzal et al., 1999; E. F. Philbin & DiSalvo, 1998; Rathore et al., 2003).

Although African Americans who have Medicare receive comparable quality of care to other ethnic and racial groups, African Americans had slightly higher rates of HF readmission, and poorer 1-year mortality level compared to whites (Wheeler et al., 2004). Also, African Americans were found to utilize hospitals for HF management more often than whites (Lafata, Pladevall, Divine, Ayoub, & Philbin, 2004). African Americans have the lowest decreases in HF hospitalization rate for the period of 1998-2008 (Chen, Normand, Wang, & Krumholz, 2011). Hispanics patients with HF were found to have different representations than any other racial group. They have unique needs that require different strategies to address these needs, including designing special HF management programs for Hispanics that are sensitive to their cultural background (Vivo, Krim, Cevik, & Witteles, 2009).

The length of hospital stay for HF patients was correlated with readmission. The research by H. M. Krumholz et al. (1997) implied that the chances for HF readmission (within 180 days) increase significantly for patients hospitalized for more than a week. For patients hospitalized more than 2 weeks, the risk for rehospitalization rose 3.2 fold in the first year after discharge (Tsuchihashi et al., 2001).

In general, patients who lived in a lower income area, such as rural areas, had a higher risk for rehospitalization (F. Philbin, Dec, Jenkins, & DiSalvo, 2001). The change in weight during hospitalization was found to increase the chances for readmission in HF

patients (Thavendiranathan et al., 2013). In addition, body mass index was found to be a significant predictor for 30-day HF readmission, the increase in BMI was found to be significant in elevating the chance for HF readmission (Prasun et al., 2013). However, Ogah et al. (2014) found that the decline in BMI is linked to higher rate of HF readmission. Finally, a history of prior hospitalization was linked to more repeated rehospitalization as implied in several studies (Darze et al., 2007; Felker et al., 2003; Gackowski et al., 2004; Kossovsky et al., 2000; H. M. Krumholz et al., 1997).

Other cardiovascular factors anticipated to influence HF unplanned rehospitalizations include heart rate, and HF class based on the New York Heart Association (NYHA) Functional Classification. The elevated heart rate for HF patients during hospitalization was linked to increased markers for 30 and 60-day readmissions (Bettencourt et al., 2004; Sliwa et al., 2013; Triposkiadis et al., 2009). Moreover, the NYHA class was found to be associated with HF rehospitalization. The literature shows that the more advanced in NYHA class at discharge the more risk for higher 30-day and one year HF rehospitalization (Feola et al., 2008; Toshimi Koitabashi et al., 2005; R. Lee et al., 2009).

## Physiological Factors

The physiological factors known to have influence on HF, and consequently rehospitalization were divided into cardiovascular factors such as, high blood pressure, coronary artery disease, peripheral artery disease, arrhythmia, and heart valve problems, and non-cardiovascular factors such as, endocrine, renal, respiratory, metabolic, neurological, musculoskeletal, nutritional, and hematopoietic (Metra et al., 2011). Also,

HF rehospitalizations were influenced by certain abnormal laboratory values, and certain cardiac medications. Over the past decades, these are the main physiological factors that show influence on the incidence of HF, and are important to control, if we are looking to better manage HF, and reduce the associated unplanned rehospitalizations.

**Cardiovascular Factors**

Generally, the influences of the different physiological factors on HF rehospitalization have been examined thoroughly in the nursing and medical literature. The combination between HF and ischemic related conditions such as, myocardial infarction, coronary artery bypass graft, and percutaneous transluminal coronary angioplasty correlates significantly with patients' rehospitalization (Evangelista, Doering, & Dracup, 2000; Felker et al., 2003; Kossovsky et al., 2000; R. Lee et al., 2009). Ejection fraction (measurement of how healthy the heart is pumping) is found to be a determinant for HF readmission (G. C. Fonarow et al., 2007; MacDonald et al., 2008; Sliwa et al., 2013), mainly low ejection fraction is linked to a higher rates of HF rehospitalization (Babayan et al., 2003; Pernenkil et al., 1997).

One of the main cardiovascular conditions that influence HF rehospitalization rates was hypertension (Tsuchihashi et al., 2001). The prevalence of hypertension in HF patients is increasing, Braunstein et al. (2003) reported that the prevalence of high blood pressure in a group of 122,630 older adults with HF was more than fifty percent. As hypertension is a common phenomenon found in HF patients, the need to address it became an underpinning in the process of identifying HF patients at higher risk for unplanned rehospitalization. Low blood pressure was found to be a determinant for HF

rehospitalization as well (Brophy, Dagenais, McSherry, Williford, & Yusuf, 2004; Felker et al., 2003; Levy et al., 2006). The odds of HF readmission were elevated when systolic blood pressure was increased at discharge in contrast to admission (Wettersten, Wilson, Tong, & López, 2014). Moreover, the risk for readmission in two months was anticipated by the value of systolic blood pressure on admission (Sliwa et al., 2013). The study conducted by Vinson, Rich, Sperry, Shah, and McNamara (1990) found that uncontrolled high blood pressure is a significant determinant for readmission in elderly patients with heart failure. In addition, the presence of hypertension prompts health care providers to use certain medications or special devices to minimize the complications of uncontrolled high blood pressure, consequently, reduce the chance for HF rehospitalization.

Coronary artery disease is believed to cause HF with the presence of hypertension (Go et al., 2014). Generally, coronary artery disease with HF increases the chances for lethal events and mortality (Metra et al., 2011). In addition, it is linked to a significant increase in the chances of rehospitalization in patients with HF. For example, African Americans with HF who suffer from angina pectoris during hospitalization were found to have a significantly heightened chance for readmission within the first year after discharge (Muzzarelli et al., 2010; Ofili et al., 1999). If a patient had a myocardial infarction during the course of hospitalization, the likelihood for rehospitalization in the first 360 days after discharge increases significantly in HF patients (Blackledge et al., 2003). Atrial fibrillation was identified as a predictor for rehospitalization when

associated with reduced or preserved ejection fractions in patients with HF (Ahmed, Thornton, Perry, Allman, & DeLong, 2004; T. Koitabashi et al., 2005; Ogah et al., 2014).

Heart valve diseases among HF patients elevates the probability for readmission (C Berry et al., 2005; Ogah et al., 2014). Peripheral vascular disease is another comorbidity found to be related to increased HF readmission (Anand, Ventura, & Mehra, 2007). In addition, peripheral vascular disease is responsible for increase loss of life and unplanned rehospitalizations (Metra et al., 2011). Aranda, Johnson, and Conti (2009) found that the presence of peripheral vascular diseases with HF increased the chance for readmission in HF patients 65 years and older. Cerebrovascular disease is linked to heart failure, mainly ischemic cerebrovascular disease. The chances for ischemic cerebrovascular disease increased with the presence of heart failure and HF rehospitalizations.

**Non-Cardiovascular Factors**

Several non-cardiovascular factors are linked with unplanned rehospitalizations in adults with HF. These factors are number of comorbidities, diabetes, anemia, chronic obstructive pulmonary disease (COPD), renal disease, pulmonary embolism, obstructive sleep apnea, and other conditions reflected by abnormal laboratory values (e.g. anemia and hyponatremia).

The number of chronic conditions (comorbidities) was found to influence the rehospitalization rates especially in older adults with HF (Go et al., 2014). Diabetes and anemia were found to influence HF rehospitalization, as well as, chronic obstructive pulmonary diseases (COPD) and renal disease (Braunstein et al., 2003; Dunlay et al.,

2009; Ogah et al., 2014). In a study by Aranda et al. (2009), it was noted that the antecedents for HF rehospitalization included the presence of one of these comorbidities with HF, such as, diabetes and renal disease. Moreover, renal disease was found significant in increasing 30-day rehospitalization in HF patients (Whittaker, Soine, & Errico, 2015). One of the major comorbidities reported in different studies to increase HF readmission was diabetes mellitus. The risk for readmission in HF patients who have diabetes increases significantly. In some cases, up to 28% of the HF patients (preserved >40% or reduced ≤ 40% ejection fraction) with diabetes were rehospitalized within 30-day after discharge (Greenberg et al., 2007; H. M. Krumholz et al., 2000; MacDonald et al., 2008). Furthermore, anemia (lower than normal levels of red blood cells) was found to be associated with 30-day rehospitalization in HF patients (Felker, Adams, Gattis, & O'Connor, 2004; Muzzarelli et al., 2010). Anemic patients with HF (have hemoglobin level with less than 12 grams per deciliter) had heightened probability for rehospitalization within the first 30, 60, and 90-day after discharge (C. Berry et al., 2006; Ezekowitz, Bakal, Kaul, Westerhout, & Armstrong, 2008; Kosiborod et al., 2005; Luthi Jc, 2006; Young et al., 2008).

The influence of COPD on HF patient has been evaluated, and COPD has increased HF readmission rates (C Berry et al., 2005; Braunstein et al., 2003; Harjai, Thompson, Turgut, & Shah, 2001; Howie-Esquivel & Dracup, 2007). Also, pulmonary embolism is a determinant for readmission in HF patients within three months (Darze et al., 2007). Finally, obstructive sleep apnea in HF patients multiplied the probability for rehospitalization to almost double, and the lack of compliance with the continuous

positive airway pressure (CPAP) therapy increased the chances for rehospitalization to almost four times (Kasai et al., 2008).

**Abnormal Laboratory Values**

Different laboratory values and associated conditions have shown to influence HF readmission. The level of hemoglobin was identified as one of the markers for early rehospitalization in patients with HF, low level of hemoglobin at admission is linked to a higher risk for rehospitalization (Felker et al., 2003; Prasun et al., 2013; Young et al., 2008). Increased hemoglobin in 20g/l was associated with a 28% decrease the chances for HF rehospitalization (C Berry et al., 2005). A lower level of hematocrit (percentage of red blood cells in blood) correlates significantly with higher rehospitalization rates (Kosiborod, Smith, Radford, Foody, & Krumholz, 2003).

Hyponatremia (the low level of sodium) was identified as a determinant for readmission in HF patients within three months after discharge (Darze et al., 2007; Ogah et al., 2014), readmission within the first 180 days after discharge (Milo-Cotter et al., 2008) , and rehospitalization within 12 months after discharge (Del Carlo, Pereira-Barretto, Cassaro-Strunz, Latorre Mdo, & Ramires, 2004). In a study by M. Gheorghiade et al. (2007) it was noted that for every 3mmol/L increment reduction in level of sodium on admission (under 140 mmol/L), the chances for mortality and rehospitalization increased by 8% after discharge. Finally, the rise in the sodium level by 5 mmol/L during hospitalization was noted to correlate with 40% lower rehospitalization rates among HF patients (C Berry et al., 2005).

Liver function test, mainly, total bilirubin has been known to be a determinant for rehospitalization in HF patients (Shinagawa et al., 2008). Blood sugar levels during hospitalization is known to influence rehospitalization in HF patients with diabetes. Each two mmol/L rise in patient's blood sugar level increases the chances for rehospitalization by eight percent (C. Berry, Brett, Stevenson, McMurray, & Norrie, 2008). An increase of one percent in the level of Hemoglobin A1c was found to increase the risk for rehospitalization in HF patients by twenty five percent (Gerstein et al., 2008). Additionally, the level of serum creatinine (marker of kidney function) was associated with rehospitalization in patient with the diagnoses of HF whether the ejection fraction declined or was conserved (Bettencourt et al., 2007; Prasun et al., 2013; Rodriguez-Artalejo et al., 2006; Rodriguez-Artalejo et al., 2005). A rise in the level of blood urea nitrogen (BUN) is found to be associated with higher risk for HF rehospitalization (C Berry et al., 2005; Giamouzis et al., 2009; Sliwa et al., 2013) and uric acid was found to increase the chances for rehospitalization in males and females when it increased by 7mg/dl and 6 mg/dl respectively (Niizeki et al., 2006).

The value of natriuretic peptide has been identified as a marker for rehospitalization in HF studies, especially the level of B-type natriuretic peptide (BNP). The value of BNP when patients were admitted to the hospital or discharged was known to determine the probability of readmission in HF patients (Cheng et al., 2001; Ferreira et al., 2007; Gackowski et al., 2004; Valle, Aspromonte, Carbonieri, et al., 2008; Valle, Aspromonte, Giovinazzo, et al., 2008). A decline in the level of BNP is an indicator for improving patients outcomes and decreasing readmission rates (Bettencourt et al., 2007;

Bettencourt et al., 2004; Pimenta et al., 2007; Verdiani et al., 2008). In addition, the likelihood of HF readmission is found to be greater with an increase in the level of BNP (Wettersten et al., 2014). The level of cardiac Troponin (protein helps in identifying myocardial infarction) during hospitalization was a marker for rehospitalization in HF patients (Araujo et al., 2009; Ishii et al., 2003; Nishio et al., 2007; Perna et al., 2005; Verdiani et al., 2008).

**Medications**

The management of HF medications is challenging for both health care providers and patients as requires understanding the purpose of prescribed treatment, as well as, the associated side effects. The latest guidelines published by the American College of Cardiology/American Heart Association and the Heart Failure Society of America, indicated that the goal of HF therapy is to postpone, or prevent the damage to heart muscle, and in turn decrease deaths associated with HF using the combination of angiotensin converting enzyme (ACE) inhibitors and B-blockers (BB) (Lindenfeld et al., 2010). HF patients are encouraged to follow the medication recommendations provided by their health care providers, and take the prescribed medications as scheduled. In addition, HF patients need to follow the directions of health care providers about avoiding selected medications as they increase the chances for exacerbation, such as, calcium channel blocker and NSAIDs (Hunt et al., 2009).

Although the awareness related to controlling the comorbidities associated with HF, such as hypertension, is increasing, the rates of compliance with medications are not satisfactory (Roger et al., 2012). The use of anti-hypertensive medications play an

important role in controlling blood pressure and minimizing the associated complications, mainly, HF (Lenfant, Chobanian, Jones, & Roccella, 2003). The process of preventing HF by controlling hypertension or other risk factors can be reflected significantly in reducing the costs of treating HF patients (Daviglus, Lloyd-Jones, & Pirzada, 2006).

The use of pharmacological and non-pharmacological therapies to treat HF has a significant influence on HF rehospitalization rates (H. Bueno et al., 2010). The odds for readmission in HF patients rise with the increase in the number of discharge medications (Wettersten et al., 2014). Multisite large studies have revealed that prescribing one of these medication classes, such as, (ACE) inhibitors, angiotensin II receptor blockers (ARBs), or (BB) at discharge, can reduce 60 to 90 day HF rehospitalizations rates (Corrao et al., 2015; C. Fonarow et al., 2007). Therefore, the current recommendation by the American College of Cardiology Foundation and American Heart Association encouraged the use of ACE inhibitors (help in reducing blood pressure) if tolerated in all patients with a history of myocardial infarction and low ejection fraction to prevent HF. If the use of ACE inhibitors is not permissible, then health care providers are encouraged to use ARBs (Yancy et al., 2013).

In general, the use of ACE inhibitors, ARBs, and BB in treating HF patients aims to slow the heart muscle deterioration and help in managing the associated symptoms. The use of beta-blocker in HF patients aims to reduce the influence of catecholamine, such as, epinephrine and norepinephrine, which intensify the amount of work done by the heart, and over time improve the functionality of heart's muscle (Yancy et al., 2013). Beta-blockers lowers heart rate, and cardiac output, consequently, decreases blood

pressure. Diuretics are another class of drugs used in HF patient population to remove the extra fluid and sodium from the body and lessen generalized and peripheral edema. Diuretics help in reducing the symptoms associated with HF, mainly, shortness of breath that result from fluid in the lungs. The use of diuretics to treat HF patients was found to be a significant determinant for 30-day HF rehospitalizations (Corrao et al., 2015). Finally, digitalis is used in HF patients to strengthen the contraction of heart muscle.

## Psychological Factors

Psychological factors identified in the literature to influence HF rehospitalization include depression and anxiety. Depression is a common mental illness in adults with HF (Hägglund, Boman, Lundman, & Brulin, 2008). The prevalence of this condition in HF patients is increasing significantly (Albert & Zeller, 2009). HF and depression share different symptoms, and the presence of depression known to worsen the signs and symptoms of HF. Moreover, the associated symptoms, such as fatigue was found to increase the chances for HF rehospitalization (Song et al., 2009) and mortality (Johansson, Dahlström, & Alehagen, 2007; Macchia et al., 2008). In a study by Song et al. (2009) it was suggested that approximately 25% of the participants with a diagnosis of depression were readmitted to the hospital. A different study by Albert and Zeller (2009) found that among the 219 participants in the study, slightly less than half of the participants had depression associated with HF. The same authors reported that regardless of the increase in the level of depression, the belief that HF can be controlled was not associated with the increase in the level of depression. The conclusion was that HF patients are recognizing the presence of depression, yet they are unable to regulate it.

Depression was found to influence the level of self-care in HF patients. Generally, HF patients who are diagnosed with depression showed a lower ability to care for themselves, which results in other heart complications and increased rehospitalization rates (Holzapfel et al., 2009). Anxiety has been addressed in the HF literature with more than one study indicating that anxiety is linked to HF rehospitalization. In a study conducted by Volz et al. (2011) to assess the influence of several psychological conditions on HF rehospitalizations, severe anxiety was significantly linked to HF rehospitalizations. In another study by Amarasingham et al. (2010), it was implied that depression and anxiety were among the factors that determines 30-day HF rehospitalizations.

## Role Function Factors

Socioeconomic status (SES), a role function factor, had influence on HF rehospitalization. A study of medical records for Medicare and Medicaid beneficiaries admitted to the hospital with the diagnosis of HF showed that there is an association between SES and both quality of care, and 30-day mortality. Moreover, one-year mortality and the risk of patient readmission were significantly higher in patients with lower SES (Rathore et al., 2006). Lower SES was significantly associated with increase in HF readmission (F. Philbin et al., 2001). A research study conducted by F. Philbin et al. (2001) indicated that the lower income in HF patients, was related to higher rehospitalization rates. In addition, the type of health insurance (Medicare, Medicaid, or private insurance) was linked to unplanned readmission for HF patient. Allen, Smoyer Tomic, Smith, Wilson, and Agodoa (2012) published a report comparing avoidable HF

readmission rates in patients with Medicaid versus commercial insurance. Those authors noted that the rates of readmission were greater in Medicaid beneficiaries and persons younger than 65 years. In addition, readmission rates for both Medicaid and private insurance beneficiaries were lower than for Medicare beneficiaries. Unemployment in HF patients significantly increased the chances for rehospitalization (Tsuchihashi et al., 2001). Moreover, it was found that when HF patients have limited family support and live by themselves, smoke, and consume alcohol, their risk for rehospitalization increases significantly (Evangelista et al., 2000).

Education and patient's level of knowledge were found to be significant factors in predicting rehospitalization in HF patients (Keri, Cathleen, Galen, Ali, & Robert, 2008). The educational level and income were both major factors that affected the level of self-care in elderly with HF (K. Moser & Watkins, 2008). The current generations of elderly have a lower educational level than other age groups, which may decrease adherence to a better and healthier self-care activities and lifestyle. This lack of adherence may increase their risk for readmission and lower quality of life (van der Wal et al., 2006).

## Current Knowledge and Gaps in the Literature

HF and the associated readmissions have been a major focus by a great deal of researchers in this field. The influence of the unplanned rehospitalizations among HF patients has continued to be a major concern for patients and their families, caregivers, and health care systems. HF influences key aspects of a patient's life, including the financial, emotional, psychological, and physical aspects (Giamouzis et al., 2011). Studying HF has led to an increase in the knowledge about HF and while the associated

treatment modalities have contributed to a significant increase in positive health outcomes, like improved HF disease management and better strategies in preventing HF readmission. HF is a condition that requires a great amount of collaboration between multiple disciplines, including health care providers, nurses, physical therapist, occupational therapist, pharmacist, and dietitians. Health care providers have a vital role in HF management and readmission prevention. In addition, providers play a major role in reducing patients' length of stay, providing high quality care when symptoms exacerbate, as well as relieving patients' pain associated with HF, safely discharging patients to appropriate setting, and minimizing HF unplanned rehospitalizations (Giamouzis et al., 2011).

Typically, health care providers who treated HF patients utilized knowledge from the latest research, standards, and evidence-based practices. The use of those practices to guide the care for HF patients significantly reduces the probability of undesirable outcomes, such as mortality, lower level for quality of life, and readmissions (Yancy, 2000). However, selected studies have shown that even when HF patients follow instructions and were compliant with the treatment regiment, health outcomes such as readmission, self-care, quality of life, morbidity, and mortality did not change or improve consistently. This phenomenon may have occurred because interventions provided did not account for the uniqueness of each HF patient (de Lusignan, 2001; Lorig K, 1985; Neily et al., 2002).

The literature focused on identifying different factors that influence HF rehospitalizations as a foundation for successful interventions to reduce the rates of

unplanned rehospitalizations. The early identification of those factors has continued to play a major part in developing a successful discharge plan that addresses the needs of HF patients to many researchers. Studies have examined HF rehospitalization among different samples at multiple points after discharge (7, 30, 90, 180, and 360 days), using different designs, and different sets of variables or factors in each study. However, in clinical settings, health care providers have lacked consistent understandings of interventions that significantly reduced unplanned HF rehospitalizations.

Studies about HF rehospitalization have been emerging, and yielded contradictory results. For example, some studies noted that age influenced HF rehospitalization; whereas others reported that age has no influence. The inconsistency in those results decreased the ability to generalize findings, and develop interventions. Generally, it is a complex process to determine patients at higher risk for rehospitalization, because each HF patient is a unique individual, in addition, the measures and instruments used on one sample might not be valid for different groups of HF patients. Therefore, factors that influence unplanned rehospitalization in HF patients need to be explored, to ascertain an agreement of what increases the occurrence of 30-day unplanned rehospitalizations. Accordingly, health care providers can target those factors, and develop interventions to reduce HF 30-day unplanned rehospitalizations.

With the large amount of studies that aim to identify factors that influence HF rehospitalization, recognizing the precise factors was challenging (Giamouzis et al., 2011). The current literature had three main areas that required further investigation. These areas included the presence of comorbidities and their influence on HF, the

influence of  non- medical factors (for instance: compliance with diet, exercise and medications) on HF patients, and the evaluation and management of HF exacerbation (Giamouzis et al., 2011).

The presence of multiple comorbidities besides HF, such as, COPD might intensify the signs and symptoms of HF or completely cover them. With multiple comorbidities, it becomes more challenging to focus on treating HF only and ignore the other conditions, such as diabetes. Moreover, the presence of multiple comorbidities makes it harder on health care providers to identify the actual factors that increase the chances for HF rehospitalization. Therefore, this study included multiple identified comorbidities to have better understanding for the 30-day unplanned rehospitalizations in HF patients.

The other gap in the literature identified in the prediction of HF rehospitalization was the focus on different outcomes beside HF. Studies have concentrated on mortality with rehospitalization or addressed HF rehospitalization as an outcome using different methods: the first method was studying HF with other cardiovascular and non-cardiovascular conditions. This was called all cause rehospitalizations. The other method for studies was HF as an outcome within a group of single cardiac conditions only, such as MI. As a final point, the last method identified was to study HF only as an outcome without the consideration of other outcomes. The variations in studying HF without considering other conditions limits the generalizability of those results (Giamouzis et al., 2011).

The final gap in the literature was the variation in the time period when the incident of HF rehospitalization occur, and the connection to different interventions developed to prevent unplanned rehospitalizations. Some studies addressed rehospitalization within the first week after discharge, while other studies have focused on 14, 30, 90, 180, and 360 days post discharge. Usually the interventions for HF patients rehospitalized within the first month were different from interventions designed to address HF patients rehospitalized within longer time periods. Commonly, the time after HF patients were discharged might indicate the area that needs more consideration by health care providers to prevent HF rehospitalization. For example, when researchers were trying to study unplanned rehospitalization in HF patients within 7-30 days, the evaluation of the hospitalization period should be considered. Therefore, this study included, contextual factors (patient characteristics), physiological factors (conditions, diagnoses, laboratory values and medications), psychological factors (depression and anxiety), and role function factors (patient's living situation, marital status, insurance, and employment status) during the period of hospitalization. This approach provided a more clear understanding of the factors that influenced (increased or decreased) unplanned rehospitalization in HF patients.

## Summary

HF was addressed in the literature, with few studies focusing on an age span of adults. Factors such as, patient's characteristic, physiological factors, psychological factors, and role function factors were identified to influence HF readmission rates, yet, the rates are increasing significantly. It could be that the factors identified in one study

vary based on the location of the sample and settings, as well as, the characteristics of that sample. Alternatively, different combinations of factors under study may have contributed to the inconsistency in results reported. Therefore, identifying the factors that increased the chance for 30-day HF unplanned rehospitalizations in a specific setting (hospital) was important. Health care providers should be encouraged to identify those patients at higher risk for 30-day HF unplanned rehospitalization, identify the factors that lead to higher percentages of 30-day HF unplanned rehospitalization, and develop tailored interventions to reduce 30-day HF unplanned rehospitalization.

When health care providers better understand the factors (e.g. patient's characteristic, physiological factors, psychological factors, and role function factors) that significantly influence patient's adaptation, and increase the risk for 30-day HF unplanned rehospitalizations (maladaptation), they participate in the process of saving health care systems from wasting billions of dollars. The saved money could be used in other areas such health promotion and disease prevention. Therefore, this study was conducted in an acute care setting using a sample of adults with HF. The factors included in the study included contextual factors (patient's characteristics), physiological factors, psychological factors, and role function factors.

# CHAPTER III

# METHODOLOGY

## Research Design

The design for this study was a descriptive retrospective design. The main independent variables in the study were patient's characteristic, physiological factors, psychological factors, and role function factors, and many of those variables could not be ethically manipulated (Polit & Beck, 2012). The primary outcome in this study was the maladaptation of HF to the independent variables, which resulted in a 30-day unplanned rehospitalization. The retrospective nature of the study means that a current phenomenon (30-day unplanned rehospitalization in HF patient) was explored using existing data (Polit & Beck, 2012).

## Setting

The study took place in an urban hospital that served a number of counties in central and western North Carolina. The hospital served an approximately 200,000 resident area. In this hospital, HF was the number one diagnosis with the highest rehospitalization rates within the first 30 days after discharge (up to 48%). The hospital serves a county in which heart disease was a leading cause of death in white males. The average age in this county was 39.2 years and the median income was estimated at $42,000 per year. The major reported ethnicities were white (79%) and black (15%). Only twenty-nine percent of the residents 25 years of age and older had a high school

diploma, 18% had a bachelor's degree, and 5% of persons had a graduate degree. Eighteen percent of the residents lived at the poverty line (Department of Social Services, 2013).

## Sample

A convenience sample was used to answer the primary research questions. Records of patients 21 years and older discharged from the hospital with a primary diagnosis of HF, and an International Statistical Classification of Disease and Related Health Problems (ICD-9) codes 428.0, 428.1,428.20,428.21,428.22,428.23,428.31, and 428.32 during a three year period (2013-2015) were used. The principal investigator was provided with a list of medical record and encounter numbers for heart failure patients who were rehospitalized and not rehospitalized within the past three years, based on the criteria of inclusion and exclusion set by the investigator. A total number of 270 participants was the final sample size for the study.

The inclusion criteria were:

Discharged with the ICD-9 code that represent HF

Twenty-one years of age and older.

Discharged alive from the hospital.

And all HF (ICD-9 code) persons rehospitalized within 30-days after discharge.

The exclusion criteria for the patients in this study include:

Twenty years of age or younger.

Admission to the hospital under observation status.

Discharged to hospice or deceased.

The sample provided ample size to answer the research questions. A total number of 138 HF patient records showed unplanned rehospitalization occurred within the past three years. Furthermore, to review the factors associated with the outcome variable (unplanned 30-day rehospitalization or not), a total number of records for 132 HF patients who had not been rehospitalized within 30-days were included. The sample met the recommendation by (Voorhis & Morgan, 2007) that when using six or more predictors (independent variables) the absolute minimum of participants should be 10 per predictor. Further, using Peduzzi, Concato, Kemper, Holford, and Feinstein (1996) formula for logistic regression, the sample figures yielded N = 10 (k) / p in the most complex model, 15 covariates with .48 positive cases in the population, thus the minimum number of cases required was N = 10 x 15 / 0..48 = 312. If the most complex model was using 12 covariates with .48 positive cases, N = 10 x 12 / 0.48 = 250.

Table 1. Sample Size Estimations

| **# of Covariates or independent variables** | **Smallest proportion of negative or positive cases** | **Calculation** | **Sample size required** |
|---|---|---|---|
| 15 | 0.48 | 10 x 15 /0.48 | 312 |
| 12 | 0.48 | 10 x 12 /0.48 | 250 |
| 10 | 0.48 | 10 x 10 /0.48 | 208 |

NOTE: Based on Peduzzi, et al (1996) recommendations and formula for logistic regression.

## Data Collection

The main independent variables included in the study were patient's characteristics, physiological-physical mode, self-concept mode, and role function mode factors (appendix 2). The main dependent variable in this study is 30-day unplanned rehospitalization in HF patients as maladaptation.

The PI accessed and extracted electronic medical records of HF patients for a three-year period. The source of data included, history and physical (H&P), progress notes, physicians consults, therapy consults, medication administration records (MAR), nursing assessment, nurse notes, case management assessment, case management notes, laboratory reports, radiology reports, and cardiology reports. The PI linked a unique ID number with the each medical record and encounter number. The PI accessed the list of eligible participants provided, since hospitals usually track HF patients and rehospitalization as a quality measure.

The hospital used electronic medical records; therefore, the investigator was granted access to patient's EMR for study data. A checklist developed by the PI used to facilitate the process of data collection from the electronic medical records (appendix 1). The electronic medical records that met the criteria for inclusion were reviewed for completeness and to avoid duplication of patients. Independent variables were collected on each patient as available. Data were extracted from the electronic medical records by the investigator at the hospital. All variables except insurance status (principal payer), discharge disposition and days between encounter pair (only in rehospitalized HF patient)

were hand extracted onto data collection forms with variable codes for numeric values and written text for string variables.

The investigator randomly checked the study data forms for match with electronic medical record information. Then, the data were double-entered into an Excel spreadsheet. Data were saved on a secure hospital laptop computer with double password protection and secure software access, and data were crosschecked for accuracy. After all data were input, downloaded and checked, a random number was determined to select 10% of the cases for a second accuracy check across all variables. Finally, the dissertation committee member randomly selected 10% of the cases, as well as any outliers, to review. Less than 0.1% of the data had errors to be fixed. After the PI finished data collection and cleaning, the excel data were exported to (SPSS v. 23) and checked for accuracy and final coding prior to analysis (SPSS Inc., Chicago, IL).

Confidentiality was maintained throughout the research process to the extent permitted by the law and the IRB. Health Insurance Portability and Accountability Act (HIPAA) guidelines and rules in the process of data collection were followed. All data were securely stored in firewalled, password protected computers or servers for electronic data and a locked cabinet accessible only through two ID secured doors.

## Reliability and Validity

The conceptual framework and the adaptive modes guided the selection of variables. Specific indicators within each mode were consistent with health indicators and outcomes used were similar to those used in the National Health Interview Survey, the National Health and Nutrition Examination Survey, and the National Quality

Measures Clearing house. Similarly, the variables, data points and their specific values and categories were those used by Centers for Disease Control and Prevention, the Center for Medicare and Medicaid Services, the American College of Cardiology and the American Heart Association. In general, based on the range for normal values provided by the hospital, the PI determined whether a given laboratory values were normal or abnormal. To facilitate the process of identifying drug classes, the PI listed the main medications under each class type, and then determined if HF patient was taking any of these medications over the course of hospitalization.

## Data Analysis Plan

There were 270 HF patients in this retrospective study. The PI recoded certain variables in an effort to meet the assumptions of statistical analyses. Descriptive statistics and univariate analysis were completed, and the results include means ± standard deviation (SD) for variables, such as, age, length of stay, body mass index, ejection fraction, number of previous hospitalizations within the past three years, difference between weight on discharge from weight on admission, and a number of laboratory values. In addition, frequencies and percentages for variables, such as, gender, race, marital status, living situation, the presence of certain diseases and conditions, New York Heart Association for HF classification, employment status, and the use of certain medications were described.

First, the continuous variables were checked for normality. Three variables were normally distributed, and these included the level of hemoglobin on admission, the level of hematocrit on admission and at discharge. For the normally distributed variables, a t-

test was performed between continuous variables, and the categorical variable (rehospitalized /not rehospitalized). When the assumption for the t-tests was not met, a Mann-Whitney U test was used to evaluate the individual relationships between the independent variables and dependent variable (rehospitalized /not rehospitalized).

The goal of the statistical analysis was to explore the relationship between the outcome, 30-day unplanned rehospitalization in HF patients (dependent variable), and the associated factors (independent variables) including patients' characteristics, physiological factors, psychological factors, and role function factors. The PI computed descriptive statistics initially to calculate measures of central tendency, such as frequency, mean, and standard deviation, for all variables. The continuous variables were checked for outliers and normality in univariate analysis using boxplots, normal P-P plots, and Kolmogorov-Smirnov tests. A two-sided p-value $\leq 0.05$ was considered statistically significant.

The pattern of missing values was assessed and examined because the number and trends of missing data could have major influence on the results of a given study (Bilheimer & Klein, 2010; Bilheimer & Sisk, 2008). For this study, missing data from the electronic medical records was in two forms. Laboratory values for some patient records were not present on the level of uric acid on admission and discharge, C-reactive protein, and troponin T because none had been ordered. Other missing data followed no pattern and was less than 0.1% of the data points. The final technique was to consider deleting the participant who has missing values from the study, which would have significantly

reduced the number of participants (Bilheimer & Klein, 2010). No cases were identified with missing data to be deleted in the analyses.

Transformations or imputations were considered but none were necessary. For a few outliers, analyses were run with and without the outliers. If the analysis results did not change, the PI kept the outliers and used standardized scores or computed non-parametric statistics.

The first research question in this study was analyzed first using bivariate correlations and chi square analysis, and the second level of analysis used logistic regressions. The assumptions were checked before running the analyses. This statistical test was used to model the relationship between 30-day unplanned rehospitalization, and contextual stimuli (patient's characteristics, such as, gender, race, length of stay, residency area, BMI, number of previous hospitalizations, difference in weight between discharge and admission, and NYHA). The reason behind using logistic regressions was the ability to identify if multiple factors including continuous and categorical variables were determinant for 30-day unplanned HF rehospitalization.

The second research question in this study was analyzed using two levels similar to question number one. Initial analysis was bivariate in nature, followed by logistic Regression modeling. This last statistical test was used to model the relationship between 30-day unplanned rehospitalization and physiological factors, such as, cardiovascular and non-cardiovascular conditions, laboratory values (normal or abnormal), and the types of cardiac related medication.

The third research question in this study was analyzed similar to the first two questions with a bivariate level and then logistic regression modeling. This last statistical test was used to model the relationship between 30-day unplanned rehospitalization and psychological factors, such as depression, anxiety.

The fourth research question in this study followed the same pattern of analysis used in the first three question. The bivariate analysis was completed and followed by the logistic regression to model the relationship between 30-day unplanned rehospitalization, and role function factors or patient's living situation, marital status, insurance, and employment status.

The fifth research question was answered using logistic regressions to model the combined relationship between 30-day HF unplanned rehospitalization and selected variables contextual factors of patients' characteristics, physiological factors, psychological factors, and role function mode factors.

## Institutional Review Board (IRB)

An agreement between the doctoral student as the Principle Investigator (PI) and the director of research in an urban hospital located in western North Carolina was signed. The agreement granted the PI an access to the electronic medical records for different data points. The type of data and different data collection procedures were included in the agreement between the PI and the director of research in that hospital. In addition, the PI obtained an IRB approval from the hospital and the University of North Carolina at Greensboro. Furthermore, all the policies and guidelines proposed by the

hospital were followed in the process of data collection. Data were protected through several steps for data security and to prevent deductive de-identification.

## Summary

This descriptive retrospective study was designed to evaluate the influence of different factors such as, patients' characteristics, physiological factors, psychological factors, and role function factors on 30-day unplanned rehospitalization in HF patients. The sample size was 270 patient EMR records from a regional hospital. Data was extracted and coded using Excel and SPSS. Analyses included measures of central tendency, examination of variable distributions and normality. Bivariate correlations and chi square, as well as logistic regression, were used to answer the research questions that examined the relationships between multiple factors and 30-day HF unplanned rehospitalization. IRB was obtained from the hospital and the university. Data agreements were signed. Compliance with HIPAA and data security were followed.

# CHAPTER IV

# RESULTS

The purpose of this study was to assess the influence of patient's characteristics, physiological factors, psychological factors, and role function factors on 30-day HF unplanned rehospitalization in a sample drawn from a small urban area hospital in North Carolina. Data for this study were comprised of patient electronic medical records. Data were extracted electronically and manually into an Excel spreadsheet for 270 patients admitted with a HF diagnosis during 2013-2015. After accuracy and missing data checks, the data were transferred to SPSS V.23 to run the statistical analysis required to describe the sample and answer the research questions. In this chapter, the results of this study were discussed and explained.

## Sample Characteristics

The mean age for HF patients included in this study was 68 (SD = 13.4) years. The average length of stay at the hospital for this sample was 5.11 (SD = 3.2) days, and the average body mass index for HF participants in this study was 32.60 (SD = 9.83). Overall, more than half of the HF patients included in this study were males, and more than three-fourths of the sample was white (Table 2). In addition, almost half of the HF patients were rehospitalized within 30 days (49%). Urban residents out-numbered rural residents. Two-thirds of the HF patients had three or less inpatient hospitalizations within the past 3 years. The difference between admission weight in kilograms and the

discharge weight in kilograms was calculated. A majority (81.7%) of the participants in this study encountered weight loss, and 18.3% of the participants had no change, or gained weight during hospitalization. Finally, in terms of NYHA classification, class III (48%) and IV (27%) were more predominant among HF patients than class I and II.

Table 2. Sample Characteristics (N = 270)

| **Characteristic** | ***n* (%)** |
|---|---|
| Gender | |
| Female | 130 (48) |
| Male | 140 (52) |
| Race | |
| White | 211 (78.1) |
| Black | 54 (20) |
| Hispanic | 1 (0.4) |
| Native American | 2 (0.7) |
| HF Rehospitalization | |
| Rehospitalized | 138 (51) |
| Not Rehospitalized | 132 (49) |
| Zip code | |
| Rural | 44 (16.3) |
| Urban | 226 (83.7) |
| Number of previous inpatient hospitalization | |
| Three times or less | 180 (66.6) |
| Four times and more | 90 (33.4) |
| Difference between weight on discharge and weight on admission | |
| Encounter weight loss | 201 (81.7) |
| No weight change | 4 (1.6) |
| Encounter weight gain | 41 (16.7) |
| NYHA Classification | |
| Class I | 6 (2.2) |
| Class II | 49 (18.1) |
| Class III | 130 (48.1) |
| Class IV | 72 (26.7) |

NOTE: frequency totals may not equal 100% due to missing responses or rounding.

## First Research Question

Research question number one was concerned with the relationship between the patient characteristics (contextual factors) and 30-day HF unplanned rehospitalization or no 30-day HF rehospitalization. With respect to patient characteristics, the NYHA classification had a statistically significant association with 30-day unplanned rehospitalization, meaning that the advance in NYHA is associated with a higher risk for 30-day HF unplanned rehospitalization. There were no statistically significant relationships using chi square analysis between 30-day unplanned rehospitalization and gender, race, rural/urban residence (Table 3).

Table 3. Bivariate Relationships between Patient Characteristic and 30-Day Unplanned Rehospitalization (N = 270)

| **Variable** | **Chi square** |
|---|---|
| Gender | $P = 0.55$ |
| Race | $P = 0.44$ |
| Rural/Urban | $P = 0.41$ |
| NYHA | $(X^2=9.30)$, $P = 0.026$* |

*$P<0.05$

With reference to other patient's characteristic, the age of the participants and the length of stay were not statistically significant using Mann-Whitney t-test. On the other hand, the body mass index, the number of previous hospitalization within the past three years, and the difference in weight between discharges were significantly related to and higher in rehospitalized HF patients compared to none rehospitalized HF patients (Table 4).

Table 4. Bivariate Relationships between Patient Characteristic and 30-Day Unplanned Rehospitalization (N = 270)

| **Variable** | Mann- Whitney t-test |
|---|---|
| Age | *U*(8501), *P*= 0.340 |
| Length of stay | *U*(8053), *P*= 0.090 |
| BMI | *U*(7284), *P*= 0.006* |
| Number of previous hospitalizations | *U*(5555), *P*= 0.001* |
| Difference in weight between discharge and admission. | *U*(6323), *P*= 0.020* |

*P<0.05

For the second level of analysis in this question, patient's characteristics of age, gender, race, length of stay, Rural/Urban, BMI, number of previous hospitalizations, difference in weight between discharge and admission, and NYHA classification were included in the logistic regression model. The model and observed data were not significantly different, thus the model was a good fit in understanding how the patient characteristics are related to 30-day unplanned hospitalization. Length of stay, number of previous hospitalizations, difference in weight between discharge and admission, and NYHA classification were significant predictors of whether a person experienced a 30-day unplanned hospitalization. Specifically, the likelihood of a 30-day unplanned rehospitalization increased by 11% for every additional day spent in the hospital. The odds increased 23.3% for each additional hospitalization during the 3-year period, Also, the odds of a 30-day unplanned rehospitalization were 8.2% lower for persons losing greater amounts of weight before discharge, and the odds were 63.2% lower in HF patients with NYHA II compared to NYHA IV classification, adjusting for other variables in the model (Table 5).

Table 5. Logistic Regression Analysis of Patient Characteristics and 30-Day Unplanned Rehospitalization (N = 228)

| Characteristics | OR | 95% CI | *p*-value |
|---|---|---|---|
| Gender | | | |
| Male [RC*] | - | | |
| Female | 0.825 | 0.445-1.530 | 0.542 |
| Race | | | |
| Non-Hispanic White | 0.530 | 0.247-1.137 | 0.103 |
| Other [RC] | - | | |
| Residence | | | |
| Rural [RC] | - | | |
| Urban | 1.886 | 0.865-4.111 | 0.110 |
| Length of stay | 1.110 | 1.012-1.217 | 0.028* |
| BMI | 0.967 | 0.935-1.000 | 0.053 |
| Number of previous hospitalizations | 1.233 | 1.105-1.376 | 0.001* |
| Difference in weight between discharge and admission. | 0.918 | 0.853-0.988 | 0.023* |
| NYHA | | | |
| Class I | 0.926 | 0.453-1.890 | 0.832 |
| Class II | 0.368 | 0.145-0.932 | 0.035* |
| Class III | 0.557 | 0.078-3.999 | 0.561 |
| Class IV [RC] | - | | |

Hosmer & Lemeshow *($X^2$=7.88), (df=8),* (*P* = 0.444)
^RC=reference category
*P<0.05

## Second Research Question

Physiological mode factors of health diagnoses including cardiovascular and non-cardiovascular conditions, clinical laboratory values, and medication usage were considered and there were both significant and nonsignificant relationships.

### Cardiovascular and Non-Cardiovascular Conditions

In terms of the presence of diseases and comorbidities other than HF, the majority of HF patients had hypertension (86%). Nearly half of the HF patients presented with

diabetes (53%) and a third of the participants had Atrial Fibrillation (Table 6). Forty-three percent of the HF patients included in this study had a diagnosis of coronary artery disease, and one-third had chronic obstructive pulmonary disease. Although 19% of the HF patients had been diagnosed with Obstructive Sleep Apnea, only 10% were using CPAP. In addition, close to one-fifth of the participants in this study had suffered a stroke in the past, and almost 11% of patients were anemic. Moreover, the proportion of HF patients with an ejection fraction equal to or less than 40 (reduced ejection fraction) was forty-three percent.

Table 6. Cardiovascular Related Conditions and Variables among HF Participants (N = 270)

| **Characteristic** | ***n* (%)** | |
|---|---|---|
| | **Yes** | **No** |
| The Diagnosis of Diabetes Miletus | 142(52.6) | 128(47.4) |
| The Diagnosis of Hypertension | 233(86.3) | 37(13.7) |
| The Diagnosis of Atrial fibrillation | 89 (33) | 181(67) |
| The Diagnosis of Coronary artery disease | 115(42.6) | 155(57.4) |
| The Diagnosis of Myocardial infarction | 15(5.6) | 255(94.4) |
| The Diagnosis of Angina | 2(0.7) | 268(99.3) |
| The Diagnosis of Stroke | 45(16.7) | 225(83.3) |
| The Diagnosis of Anemia | 29(10.7) | 241(89.3) |
| The Diagnosis of Chronic Kidney Disease | 61(22.6) | 209(77.4) |
| The Diagnosis of Chronic Obstructive Pulmonary Disease | 82(30.4) | 188(80.7) |
| The Diagnosis of Obstructive Sleep Apnea | 52(19.3) | 218(80.7) |
| The use of CPAP | 26(9.6) | 244(90.4) |
| Ejection fraction | | |
| Less than or equal 40(reduced) | 118 (43.7) | |
| More than 40 (preserved) | 149 (55.8) | |

NOTE: frequency totals may not equal 100% due to missing responses and rounding.

With respect to cardiovascular and non-cardiovascular conditions, the diagnosis of chronic kidney disease, and the use of CPAP in HF patients were statistically

significant related to 30-day unplanned rehospitalization. The presence of chronic kidney disease was associated with having 30-day HF unplanned rehospitalization. In addition, the use of CPAP was associated with having HF rehospitalization. The diagnosis of diabetes, hypertension, atrial fibrillation, Coronary artery disease, stroke, anemia, chronic obstructive pulmonary disease, sleep apnea, and ejection fraction were not statistically related to 30-day unplanned rehospitalization (Table 7).

Table 7. Bivariate Relationships between Physiological Factors--Health Condition/Diagnosis and 30-Day Unplanned Hospitalization (N = 270)

| **Variable** | **Chi square** |
|---|---|
| The diagnosis of diabetes | $P = 0.70$ |
| The diagnosis of hypertension | $P = 0.74$ |
| The diagnosis of A-fib | $P = 0.15$ |
| The diagnosis of CAD | $P = 0.84$ |
| The diagnosis of stroke | $P = 0.74$ |
| The diagnosis of anemia | $P = 0.06$ |
| The diagnosis of chronic kidney disease | $(X^2=12.56)$, $P = 0.001$* |
| The diagnosis of chronic obstructive pulmonary disease | $P = 0.98$ |
| The diagnosis of obstructive sleep apnea | $P = 0.09$ |
| The use of CPAP | $(X^2=7.67)$, P = 0.006* |
| Ejection fraction | P = 0.731 |

*P<0.05

Physiological mode cardiovascular and non-cardiovascular conditions were included in this logistic regression equation for second level analysis. The conditions included diabetes, hypertension, atrial fibrillation, coronary artery disease, stroke, anemia, hyponatremia, chronic kidney disease, chronic obstructive pulmonary disease, and obstructive sleep apnea with the use of CPAP. The model and observed data were not

significantly different, thus the model was a good fit in understanding how the cardiovascular and non-cardiovascular are related to 30-day unplanned hospitalization.

For health diagnoses and conditions including cardiovascular and non-cardiovascular, there were statistically significant relationships between chronic kidney disease, use of CPAP and 30-day unplanned rehospitalization. Specifically, the odds increase for 30-day unplanned rehospitalizations were 2.94 in HF patient with chronic kidney disease. Additionally, the odds of a 30-day unplanned rehospitalization were 72% lower for persons who use CPAP machine adjusting for other variables in the model (Table 8). No significant relationships were found between a diagnosis of diabetes, hypertension, atrial fibrillation, coronary artery disease, stroke, anemia, chronic obstructive pulmonary disease or obstructive sleep apnea and 30-day unplanned rehospitalization.

Table 8. Logistic Regression Analysis of Health Conditions or Diagnoses and 30-Day Unplanned Rehospitalization (N = 267)

| **Condition or diagnosis** | **OR** | **95% CI** | ***p*-value** |
|---|---|---|---|
| Diagnosed with Hypertension | 0.699 | 0.329-1.488 | 0.353 |
| Diagnosed with Diabetes | 1.579 | 0.899-2.773 | 0.112 |
| Diagnosed with atrial fibrillation | 1.474 | 0.859-2.529 | 0.159 |
| Diagnosed with Coronary artery disease | 0.899 | 0.529-1.528 | 0.694 |
| Diagnosed with Stroke | 1.041 | 0.532-2.037 | 0.907 |
| Diagnosed with chronic kidney disease | 2.940 | 1.541-5.611 | 0.001* |
| Diagnosed with chronic obstructive pulmonary disease | 1.187 | 0.681-2.069 | 0.544 |
| Diagnosed with obstructive sleep apnea. | 0.751 | 0.356-1.585 | 0.452 |
| The use of CPAP | 0.280 | 0.090-0.872 | 0.028* |

Hosmer & Lemeshow $(X^2=0.031)$, $(df=1)$, $(P = 0.861)$
*P<0.05

**Laboratory Values (Normal and Abnormal)**

The average of HbA1c (glucose control past three months) among HF patients was 7.3, meaning persons were in the diabetic diagnosis range (Table 9). In addition, 50% of the medical records showed patients had a Brain natriuretic peptide (BNP) of 630 or less, which showed an increase in ventricular secretion of this amino acid due to extra starching of the heart muscle, and meaning that HF was worsening in this group. More than six percent of the participants had a troponin I of less than or equal 0.01, indicative that there was no destruction to the heart muscle noted due to lack of coronary blood supply in this group. The average hemoglobin at admission upon discharge was slightly less than the normal range. The average level of hematocrit at admission and upon

discharge were within the normal ranges. Furthermore, the average sodium, potassium and creatinine were within normal ranges at admission and discharge. Blood urea nitrogen (BUN) averaged slightly high at admission but within normal range upon discharge.

Table 9. Laboratory Values for HF Participants (N = 270)

| **Laboratory value** | **Mean ± SD*** | |
|---|---|---|
| | Admission | Discharge |
| Hemoglobin | 11.9 ± 2.1 | 11.6 ± 2.0 |
| Hematocrit | 36.5 ± 6.2 | 35.1 ± 5.9 |
| Sodium | 136 ± 4.4 | 136 ± 3.6 |
| Potassium | 4.1 ± 0.6 | 4.1 ± 0.5 |
| Creatinine | 1.5 ± 1.0 | 1.5 ± 0.9 |
| Blood Urea Nitrogen | 26.0 ± 16.4 | 30.1 ± 15.5 |

SD = standard deviation.
NOTE: frequency totals may not equal 100% due to missing responses and rounding.

For the normally distributed hemoglobin on admission, the independent sample t-test was associated with statistically significant effect. Thus, rehospitalized HF patients had higher average level of hemoglobin on admission than those persons not rehospitalized. For hematocrit on admission, the independent sample t-test was associated with statistically significant effect. Thus, rehospitalized HF patients had a statistically higher mean of hematocrit on admission than persons not rehospitalized. With respect to hematocrit at discharge, the independent sample t-test was associated with statistically significant effect. Thus, rehospitalized HF patients had a statistically higher average hematocrit at discharge than persons not rehospitalized (Table 10).

Table 10. Relationships between Laboratory Values (Normally Distributed) and 30-Day Unplanned Hospitalization (N = 270)

| **Variable** | ***t* (df), p-value** |
|---|---|
| Hemoglobin on admission | *t*=3.75 (264.4) p=0.001* |
| Hematocrit on admission | *t*=3.93 (264.3) p=0.001* |
| Hematocrit at discharge | *t*=3.97(234.0) p=0.001* |

*P<0.05

The Mann-Whitney test was used to compare mean ranks between the laboratory values not normally distributed (mainly due to floor effect) and 30-day HF unplanned rehospitalization. The mean rank of hemoglobin level at discharge, creatinine level at admission and at discharge, blood urea nitrogen at admission and at discharge and B-type Natriuretic peptide in the rehospitalized group was statistically significantly higher than the not rehospitalized group (Table 11). No significant relationships were found between sodium on admission, sodium at discharge, potassium on admission, potassium at discharge, hemoglobin A1C and 30-day unplanned rehospitalization.

Table 11. Laboratory Values Mann-Whitney T-Test (N = 270)

| **Laboratory Values** | **Mann-Whitney t-test *U* , *P*-value** |
|---|---|
| Hemoglobin at discharge | *U*(5024),P=0.001* |
| Sodium on admission | *U*(8599), P=0.426 |
| Sodium at discharge | *U*(8191), P=0.214 |
| Potassium on admission | *U*(8039), P=0.095 |
| Potassium at discharge | *U*(8815), P=0.721 |
| Hemoglobin A1C | *U*(2159), P=0.487 |
| Creatinine on admission | *U*(6603), P=0.001* |
| Creatinine at discharge | *U*(6887), P=0.001* |
| Blood urea nitrogen on admission | *U*(6908), P=0.001* |
| Blood urea nitrogen at discharge | *U*(7584), P=0.022* |
| B-type Natriuretic peptide | *U*(6647), P=0.002* |
| The level of troponin I | *U*(8070), P=0.919 |

*P<0.05

Laboratory values mainly at discharge were included in this logistic regression equation. The laboratory values included were hemoglobin at discharge, hematocrit at discharge, creatinine at discharge, sodium at discharge, potassium at discharge, B-type natriuretic peptide, and cardiac troponin I. The model and observed data were not significantly different, thus the model was a good fit in understanding how the laboratory values are related to 30-day unplanned rehospitalization. For laboratory values, there were statistically significant relationships between the level of B-type natriuretic peptide at discharge and 30-day unplanned rehospitalization. Explicitly, the odds increase for 30-day unplanned rehospitalizations were even for each unit increase in the level of BNP (Table 12). No significant relationships were found between hemoglobin at discharge, hematocrit at discharge, creatinine at discharge, sodium at discharge, potassium at discharge, and cardiac troponin I and 30-day unplanned rehospitalization (Table 12).

Table 12. Logistic Regression Analysis of Laboratory Values and 30-Day Unplanned Rehospitalization (N = 215)

| **Laboratory Value** | **OR** | **95% CI** | **p-value** |
|---|---|---|---|
| Hemoglobin at discharge | 0.915 | 0.507-1.649 | 0.766 |
| Hematocrit at discharge | 0.964 | 0.786-1.182 | 0.725 |
| Creatinine at discharge | 1.356 | 0.899-2.046 | 0.147 |
| Sodium at discharge | 1.062 | 0.980-1.151 | 0.144 |
| Potassium at discharge | 0.574 | 0.305-1.080 | 0.085 |
| B-type natriuretic peptide | 1.000 | 1.000-1.001 | 0.050* |
| Cardiac troponin I | 0.487 | 0.015-15.614 | 0.684 |

Hosmer & Lemeshow *($X^2$=13.772), (df=8),* (*P* = 0.088)
*P≤ 0.05

**Medications**

Medication classifications used in the treatment of HF patients in this study were examined. The main group of medications that was used in the majority of HF participants was loop diuretics (87%), with Furosemide being the most frequently used medication in the treatment regimen of HF patients (80%) (Table 13). The use of Beta Blockers was noted in 207 patients, with around three-fourths of the total sample. Carvediolol (43%) and Lopressor (31%) were the most frequently used Beta-blockers. The use of Angiotensin Converting Enzymes Inhibitors was noted in almost half of the participants (46%). The Angiotensin Converting Enzymes Inhibitors most frequently utilized in the treatment of this sample was Lisinopril. There was minimal use of Angiotensin II receptor blockers (ARB) to treat HF patients in this group. Only 9.3% of the participants were on ARBs and Losartan was most frequently used.

Table 13. Common Medication Classifications Used for HF Participants (N = 270)

| **Medication classification** | **n (%)** | |
|---|---|---|
| | **Yes** | **No** |
| The use of loop Diuretics | 235 (87) | 35 (13) |
| The use of Thiazides | 15 (5.6) | 255(94.4) |
| The use of Potassium sparing diuretics | 35(13) | 235(87) |
| The use of Beta Blockers | 207(76.7) | 63(23.3) |
| The use of Angiotensin Converting Enzymes inhibitor | 123 (45.6) | 147 (54.4) |
| The use of Angiotensin II receptor blockers | 25(9.3) | 245 (90.7) |

NOTE: frequency totals may not equal 100% due to missing responses and rounding.

The *p*-value of the Chi-square test between the rehospitalized\ not rehospitalized group and the use of angiotensin converting enzymes inhibitor showed that there was a statistically significant association between the rehospitalized\ not rehospitalized HF

patients and the use of angiotensin converting enzymes. This means that 30-day HF unplanned hospitalization were significantly associated with taking angiotensin converting enzymes inhibitors. No relationships existed for the use of loop diuretics, thiazides, potassium sparing diuretics, beta-blockers, the angiotensin II receptor blocker or anxiolytics and 30-day unplanned hospitalization (Table 14).

Table 14. Bivariate Relationships between Medications and 30-Day Unplanned Hospitalization (N = 270)

| **Medication classification** | **Chi square** |
|---|---|
| The use of loop diuretics | $P = 0.49$ |
| The use of thiazides | $P = 0.72$ |
| The use of potassium sparing diuretics | $P = 0.96$ |
| The use of beta-blocker | $P = 0.81$ |
| The use of angiotensin converting enzymes inhibitor | $(X^2=3.95)$, $P = 0.047$* |
| The use of angiotensin II receptor blocker | *P=0.74* |

*$P<0.05$

In regards to medications, cardiac related medications were included in this logistic regression equation. The medications included were the use of loop diuretics, the use of thiazides, the use of potassium sparing diuretics, the use of beta-blockers, the use of angiotensin converting enzymes, and the use of angiotensin II receptors blockers. The model and observed data were not significantly different, thus the model was a good fit in understanding how the use of certain medications are related to 30-day unplanned hospitalization.

For cardiac related medications, there were statistically significant relationships between the use of angiotensin converting enzymes and 30-day unplanned rehospitalization. Explicitly, the odds for 30-day unplanned rehospitalizations were

44.1% lower for HF patients on angiotensin converting enzymes (Table 15). No significant relationships were found between the use of loop diuretics, the use of thiazides, the use of potassium sparing diuretics, the use of beta-blockers, and the use of angiotensin II receptors blockers and 30-day unplanned rehospitalization.

Table 15. Logistic Regression Analysis of Medication and 30-Day Unplanned Rehospitalization (N = 270)

| **Medication classification** | **OR** | **95% CI** | **p-value** |
|---|---|---|---|
| The use of loop diuretics | 0.763 | 0.369-1.579 | 0.446 |
| The use of thiazides | 1.169 | 0.404-3.386 | 0.773 |
| The use of potassium sparing diuretics | 1.144 | 0.549-2.385 | 0.719 |
| The use of beta-blockers | 1.089 | 0.609-1.947 | 0.773 |
| The use of angiotensin converting enzymes | 0.559 | 0.360-0.998 | 0.049* |
| The use of angiotensin II receptors blockers | 0.936 | 0.396-2.214 | 0.881 |

Hosmer & Lemeshow *($X^2$=4.713), (df=7),* ($P$ = 0.695)
*$P$<0.05

## Third Research Question

The psychological mode factors were the focus of the third research question. The presence of depression and anxiety were evaluated as variables that might have increased the chance for 30-day unplanned rehospitalization in HF patients. Depression and anxiety diagnoses were found in almost one-fourth of the participants (24%). In terms of antidepressants and anxiolytics, almost 15% of the HF patients were on antidepressants and almost 19% of patients were taking anxiolytics (Table 16). Furthermore, the result of this study showed that 61.5% of the participants diagnosed with depression were on

antidepressants. Similarly, all the participants diagnosed with anxiety were placed on some sort of anxiolytics.

Table 16. Psychological Mode Factors in the Sample of HF Patients (N = 270)

| **Characteristic** | ***n* (%)** | |
|---|---|---|
| | Yes | No |
| The use of Antidepressant | 41 (15.2) | 229 (84.8) |
| The use of anxiolytics | 51 (18.9) | 219 (81.1) |
| The Diagnosis of Depression | 65(24.1) | 205(75.9) |
| The Diagnosis of Anxiety | 64(23.7) | 206(76.3) |

NOTE: frequency totals may not equal 100% due to missing responses or rounding.

The p-value of the Chi-square test between the rehospitalized\ not rehospitalized group and the use of antidepressants is 0.017. Therefore, we conclude that there is a statistically significant association between the rehospitalized\ not rehospitalized HF patients and the use of antidepressants. This means that 30-day HF unplanned rehospitalization is associated with the use of antidepressants. The p-value of the Chi-square test between the rehospitalized\ not rehospitalized group and the diagnosis of depression and anxiety or the use of anxiolytics were not significant (Table 17).

Table 17. Bivariate Relationships between Psychological Mode Factors and 30-Day Unplanned Hospitalization (N = 270)

| **Factor** | **Chi square** |
|---|---|
| The diagnosis of depression | $P = 0.054$ |
| The diagnosis of anxiety | $P = 0.710$ |
| The use of Antidepressant | $(X^2=5.711)$, $P = 0.017$* |
| The use of Anxiolytics | $P = 0.770$ |

*$P<0.05$

The psychological mode factors were included in the logistic regression equation. The psychological factors included were the diagnosis of depression, the diagnosis of anxiety, the use of antidepressant, and the use of anxiolytics. The model and observed data were not significantly different, thus the model was a good fit in understanding how psychological factors are related to 30-day unplanned hospitalization. However, there were no statistically significant individual relationships or specific predictors between the diagnosis of depression, the diagnosis of anxiety, the use of antidepressant, and the use of anxiolytics and 30-day unplanned rehospitalization when combined (Table 18).

Table 18. Logistic Regression Analysis of Psychological Factors and 30-Day Unplanned Rehospitalization (N = 270)

| **Factors** | **OR** | **95% CI** | **p-value** |
|---|---|---|---|
| The diagnosis of depression | 0.880 | 0.330-2.353 | 0.800 |
| The diagnosis of anxiety | 1.039 | 0.265-4.079 | 0.956 |
| The use of antidepressant | 0.480 | 0.162-1.419 | 0.184 |
| The use of anxiolytics | 0.928 | 0.230-3.739 | 0.916 |

Hosmer & Lemeshow *($X^2$=0.124), (df=2),* (*P* = 0.940)

## Fourth Research Question

The impact of the role function mode factors on 30-day rehospitalization in HF patients was addressed in research questions four using marital status, living situation (alone or not), employment status and insurance status. Twenty-two percent of the participants included lived alone. In term of marital status, almost half of the HF patients were married (47%), six percent of the HF patients were unemployed, and close to 96% of the participants had insurance coverage (Table 19).

Table 19. Role Function Mode Factors (N = 270)

| **Characteristic** | ***n* (%)** | |
|---|---|---|
| | Yes | No |
| Lives alone | 61 (22.6) | 209 (77.4) |
| Marital Statues | 127(47) | 135(50) |
| Employment status | 15 (5.6) | 255 (94.4) |
| Insurance status | 259 (95.9) | 11 (4.1) |

NOTE: frequency totals may not equal 100% due to missing responses and rounding

The p-value of the Chi-square test between the rehospitalized\ not rehospitalized group and marital, employment, and insurance status showed significant associations. This means that 30-day HF unplanned rehospitalization was a dependent on the marital, employment, and insurance status of the HF patients (Table 20). On the other hand, there was no statistically significant association between the rehospitalized/ not rehospitalized HF patients and living situation.

Table 20. Bivariate Relationships between Role Function Mode Factors and 30-Day Unplanned Hospitalization (N = 270)

| **Role function mode factors** | **Chi square** |
|---|---|
| Living situation | $P = 0.09$ |
| Marital status | $(X^2=5.043), P = 0.025$* |
| Employment status | $(X^2=11.33), P = 0.001$* |
| Insurance status | $(X^2=4.327), P = 0.038$* |

*$P<0.05$

In question four, role function mode factors were included in the logistic regression equation. The role function factors included living situation, marital status, employment status, and insurance status. The model and observed data were not significantly different, thus the model was a good fit in understanding how role function

mode factors were related to 30-day unplanned hospitalization. There were statistically significant relationships between the living situation, marital status, and employment status and 30-day unplanned rehospitalization with consideration of all factors. Specifically, the odds for 30-day unplanned rehospitalizations were 57.9 % lower for HF patients living alone compared to HF patients who lives with someone. The odds for 30-day unplanned rehospitalizations were more than twice as high for unmarried HF patients compared to married HF patients. Lastly, the odds for 30-day unplanned rehospitalizations were 92.7% lower for employed HF patients compared to unemployed HF patients. No significant relationships were found between insurance status and 30-day unplanned rehospitalization (Table 21).

Table 21. Logistic Regression Analysis of Role Function Mode Factors and 30-Day Unplanned Rehospitalization (N = 262)

| **Role function factor** | **OR** | **95% CI** | **p-value** |
|---|---|---|---|
| Lives alone | 0.421 | 0.216-0.820 | 0.011* |
| Not married | 2.468 | 1.413-4.309 | 0.001* |
| Employed | 0.073 | 0.009-0.583 | 0.014* |
| Insured | 4.268 | 0.826-22.06 | 0.083 |

Hosmer & Lemeshow *($X^2$=0.031), (df=1),* ($P$ = 0.861)
*$P$<0.05

## Fifth Research Question

For this question, variables associated with or that predicted the 30-day unplanned from prior analysis in the research questions one through four were tested to build the final model of the combined influence of adaptive mode factors on the outcome. The

variables included in this logistic regression were length of stay, number of previous hospitalizations, difference in weight between discharge and admission, NYHA, the diagnosis of chronic kidney disease, the use of CPAP, BNP, the use of angiotensin converting enzymes inhibitor, the use of antidepressants, the living situation, marital status and insurance status. The model and observed data were not significantly different, thus the model was a good fit in understanding how patient characteristics, physiological, psychological, and role function factors were related to 30-day unplanned hospitalization.

There were statistically significant relationships between the number of previous hospitalizations, difference in weight between discharge and admission, the use of angiotensin converting enzymes inhibitor, the use of antidepressants, and not being married and 30-day unplanned rehospitalization. Specifically, the likelihood of a 30-day unplanned rehospitalization increased by 30.2% for every additional previous hospitalization. The odds of a 30-day unplanned rehospitalization were 11.8% lower for persons losing greater amounts of weight between admission and discharge. The odds for 30-day unplanned rehospitalization were 53% lower in HF patients on angiotensin converting enzymes inhibitors compared to HF patients not on angiotensin converting enzyme medications. The odds for 30-day unplanned rehospitalization were 76.6 % lower in HF patients on antidepressants compared to HF patients not on antidepressants. Finally, the odds for 30-day unplanned rehospitalization were more than twice as likely for unmarried HF patients compared to married HF patients, adjusting for and considering all variables in the model (Table 22). No significant relationships were

found between length of stay, NYHA, the diagnosis of chronic kidney disease, the use of CPAP, BNP, living alone or insurances status and 30-day unplanned rehospitalization.

Table 22. Logistic Regression Analysis of Variables from Patient Characteristics, Physiological, Psychological, and Role Function Modes and 30-Day Unplanned Rehospitalization (N = 219)

| **Factor** | **OR** | **95% CI** | **p-value** |
|---|---|---|---|
| Length of stay | 1.110 | 0.996-1.236 | 0.059 |
| Number of previous hospitalizations | 1.302 | 1.142-1.484 | 0.001* |
| Difference in weight between discharge and admission | 0.882 | 0.813-0.957 | 0.003* |
| NYHA I | 0.394 | 0.036-4.349 | 0.447 |
| NYHA II | 0.441 | 0.159-1.217 | 0.114 |
| NYHA III | 1.046 | 0.471-2.325 | 0.912 |
| NYHA IV[RC] | | | |
| The diagnosis of chronic kidney disease | 1.866 | 0.799-4.355 | 0.149 |
| The use of CPAP | 0.251 | 0.059-1.059 | 0.060 |
| BNP | 1.000 | 1.000-1.001 | 0.062 |
| The use of angiotensin converting enzymes inhibitor | 0.463 | 0.237-0.906 | 0.024* |
| The use of antidepressants | 0.234 | 0.083-0.659 | 0.006* |
| Living alone | 0.509 | 0.219-1.184 | 0.117 |
| Not married | 2.319 | 1.136-4.732 | 0.021* |
| Insured | 5.212 | 0.767-35.40 | 0.091 |

RC: Reference Category
*$P<0.05$
Hosmer & Lemeshow $(X^2=12.222)$, $(df=8)$, $(P = 0.142)$

# CHAPTER V

# DISCUSSION

## Introduction

The aim of this study was to evaluate the influence of contextual factors of patient's characteristics, physiological factors, psychological factors, and role function factors on 30-day HF unplanned rehospitalization using electronic medical records from a small urban area hospital in North Carolina. The Roy Adaptation Model (RAM) guided the selection of variables and provided a framework for the findings. The author used this chapter to critically examine the findings of this study, link with previous knowledge, and discuss support for the conceptual model, nursing implications, conclusions, and recommendations for further research.

The main sample characteristics or contextual factors in this study were similar to the characteristics reported in the literature. The mean age for the participants surveyed was 68 years, which is similar to what other studies suggest that older adults with HF were found to be at higher risks for readmissions (Ross et al., 2010). More than half of the patients were male, and no differences were found in 30-day unplanned rehospitalization between genders.

More than half of the participants in this study were rehospitalized within 30 days after discharge from hospital. This sample was similar to prior patients studied, in that 30-day unplanned rehospitalizations were documented in half of the participants (Joynt &

Jha, 2011; Harlan M. Krumholz et al., 2009; Setoguchi & Stevenson, 2009). In another study, rehospitalization was encountered in only 16-25% of HF patients (Keenan et al., 2008). The variation could be a result of the difference in the characteristics of patient samples, the geographic areas, and the community resources available to deal with 30-day HF unplanned rehospitalization. For the current study, the number of HF patients from an urban area out-numbered HF patients from rural area, and the number of rehospitalized patients from an urban area was higher than from the rural area. This finding was unlike the previous reports that patients who lived in a lower income area, such as rural areas, had a higher risk for rehospitalization (F. Philbin et al., 2001). The non-Hispanic White group was the dominant group, which was similar to a study conducted by Hernandez et al. (2013). The majority of the patient medical records included in the study showed weight reduction during hospitalization and the most predominant NYHA were classes III and IV. Both of these last two factors were expected based on HF physiology and diagnosis.

The first research question examined the influence of patient's characteristics on 30-day HF unplanned rehospitalization. The NYHA classification and the body mass index were related to 30-day HF unplanned rehospitalization. Also, the number of previous hospitalization within the past three years, and the difference in weight between discharge and admission were found significantly associated with 30-day HF unplanned rehospitalized. The following factors were related in the combined factor examination length of stay, number of previous hospitalizations, difference in weight between discharge and admission, NYHA class II classification as significant predictors of

whether a person experienced a 30-day HF unplanned hospitalization. The result from this study showed that the NYHA classification was associated with 30-day unplanned rehospitalization. Specifically, class II was a predictor in decreasing the chances for 30-day HF unplanned rehospitalization compared to class IV. This result was similar to the results of several previous studies (Feola et al., 2008; Toshimi Koitabashi et al., 2005; R. Lee et al., 2009).

The increase in BMI was found significantly higher in rehospitalized HF patients compared to non rehospitalized HF patients. A previous study by Prasun et al. (2013) reported similar results of increased 30-day unplanned rehospitalization with increased BMI. The increased number of previous hospitalization within the past three years was related to greater rehospitalized HF patients compared to non-rehospitalized HF patients, and this finding was supported by previous studies (Darze et al., 2007; Felker et al., 2003; Gackowski et al., 2004). The difference in weight between discharge and admission as a predictor for HF unplanned rehospitalization, with the odds were lower for HF by losing higher amounts of weight before discharge, was similar to the study conducted by (Hernandez et al., 2013), that showed the odds of HF rehospitalization decreased when patients lost more weight before discharge.

Length of hospital stay for HF patients was predictive of 30-day unplanned rehospitalization. Specifically, unplanned rehospitalization increased with longer length of stay. This finding was comparable to Tsuchihashi et al. (2001) report that the risk for HF rehospitalization increased. The result was different from the research conducted by (Héctor Bueno et al., 2010), that reported an increased rate of 30-day unplanned

rehospitalization with the decreased in length of stay. This may be due to a specific use of the Diagnosis-Related Group (DRG) payment system and moving patients out of the hospital quicker over the past decade. The new CMS rule regarding meeting metrics may provide more stability in the length of stay for HF patients and allow providers to discharge patients with their best health that will prevent 30-day unplanned rehospitalization. This study reported that NYHA classification, BMI, length of stay, number of previous hospitalizations within the past three years, and difference in weight between discharge and admission were linked to 30-day unplanned rehospitalization. This shows that 30-day rehospitalization was not related to physiological changes only; it was multidimensional phenomenon with several factors. Health care providers and nurses should evaluate multiple areas of HF patient health and lives before planning patient care and assessing readiness for discharge.

The second research question was used to examine three groups of physiological factors on the outcomes. The initial analysis examined the influence of cardiovascular and non-cardiovascular conditions on 30-day HF unplanned rehospitalization. The proportion of patients with many chronic diseases were comparable to the percentages reported by Hernandez et al. (2013). Also, the proportion of persons with an ejection fraction equal to or less than forty percent was similar to a previous report (Harjai et al., 1999). Multiple diagnoses were related to 30-day unplanned rehospitalization, with chronic kidney disease and use of CPAP similar to previous reports by Aranda et al. (2009) and Kasai et al. (2008). Those findings could be explained by volume overload in patients with chronic kidney disease, and that will increase the workload of the heart

muscle, requiring frequent return to hospital to help patient lose these fluid through the diuresis process. The use of CPAP will help in supporting the patient's airways, especially, at night. Patients with heart failure often sleep on several pillows to reach a comfortable position, which allows full expansion of the chest. The use of CPAP can reduce labored breathing and can help HF patients rest. In this study, chronic kidney disease and the use of CPAP were found to be significant predicators for 30-day HF unplanned rehospitalizations, which means HF rehospitalization could occur due to factors that are not cardiovascular related factors. At the same time, it was interesting to find that 30-day HF rehospitalization was not associated with any specific cardiovascular condition, which might be due to the fact that most of the patients experienced multiple comorbidities and cardiac conditions.

The next set of findings were related to examination of the influence of physiological factors of laboratory values (normal and abnormal) on 30-day HF unplanned rehospitalization. The average of HbA1c was high in this sample and almost half of the patient records reviewed had both diabetes and HF. In addition, half of the medical records displayed that patients had a BNP of 630 or less, which showed an increase in ventricular secretion of this amino acid due to extra starching of the heart muscle, meaning that HF was worsening in this group. Only a few of the patients had troponin I levels of less than or equal 0.01, indicative that there was no minimal destruction to the heart muscle due to a lack of coronary blood supply. The average hemoglobin at admission and upon discharge was slightly less than the normal range and the hematocrit at admission and upon discharge were within the normal ranges. Findings

are similar to current literature that addressed the level of hemoglobin on admission as influencing 30-day HF rehospitalization (Felker et al., 2003; Prasun et al., 2013; Young et al., 2008). Consistent with the current study findings, Kosiborod et al. (2003) showed an increase in the risk of HF hospitalization with lower level hematocrit. Finally, hemoglobin level at discharge in the not rehospitalized group was similar to the study conducted by C Berry et al. (2005).

There were no major electrolyte imbalances noted across the HF patients. The creatinine on admission and upon discharge in the rehospitalized group was significantly higher than the not rehospitalized group, similar to previous studies conducted by Prasun et al. (2013) and Bettencourt et al. (2007). Likewise, blood urea nitrogen on admission in the rehospitalized group was higher than the not rehospitalized group, consistent with the research outcomes from several studies (C Berry et al., 2005; Giamouzis et al., 2009; Sliwa et al., 2013). Finally, the BNP in the rehospitalized group was statistically significantly higher than the not rehospitalized group, another outcome similar to previous other reports (Bettencourt et al., 2007; Bettencourt et al., 2004; Pimenta et al., 2007; Verdiani et al., 2008).

The laboratory values were predictors of 30-day HF unplanned rehospitalization. Thus, close observations for blood levels such as cardiac enzymes, kidney function test, liver function test, and other blood works are vital to understanding the complete picture of 30-day HF unplanned rehospitalization. Achieving the preferred levels of multiple cardiac related laboratory markers can keep HF patients from 30-day unplanned rehospitalization.

Further analyses assessed the impact of cardiac related medications on 30-day HF unplanned rehospitalization. Medications used in the treatment of HF patients in this study were examined, with loop diuretics used more frequently than in a previous study by Hernandez et al. (2013). Findings from the current study were similar concerning the proportion of HF patients on beta-blockers and angiotensin converting enzymes inhibitors (Hernandez et al., 2013). The use of ACE inhibitors as vasodilator will reduce improve blood flow, and reduce the workload on the heart. Patients who used angiotensin converting enzymes were less likely to experience a 30 day HF unplanned hospitalization, similar to the study conducted by Corrao et al. (2015) and the study by G. C. Fonarow et al. (2007). In this study, only 46% of the participants were on ACE inhibitor, this was a low percentage, compared to the HF management guidelines, which states that use of ACE inhibitor is recommended to be used for all HF patients. It could be that health care providers are not educated on the importance of prescribing these medications, or patients are suffering kidney disease or having allergies to this type of medication. Therefore, comprehensive, and detailed assessment of discharge medications by the health care provider can enhance the possibility that the patient may experience reduced unplanned rehospitalizations.

The third research question was used to examine the impact of psychological factors, mainly, depression and anxiety on 30-day HF unplanned rehospitalization. Depression and anxiety were found in one-fourth of the patients, which was less than the proportion found by Albert and Zeller (2009). Findings showed that the use of antidepressants was significantly associated with 30-day HF unplanned rehospitalization,

however, the use of antidepressants was not found to be a significant predictor for 30-day unplanned rehospitalization when included with other psychological factors. When included with combined factors from different modes, antidepressant was found to be a significant predictor in reducing 30- day unplanned rehospitalization. This could be explained because depression has been linked to worsening HF symptoms, and increased chances for rehospitalization (Song et al., 2009). The use of antidepressants can reduce the severity of depression, which decreases rehospitalization. In this study, the use of anxiolytics were noted in all patients with anxiety, which probably was why anxiety was not found to be significant in predicting 30-day unplanned rehospitalization. Findings displayed that the use of pharmacological management of depression can help in improving the health of HF patients and decrease unwanted outcomes, such as 30-day HF unplanned rehospitalization.

The impact of role function factors on 30-day unplanned hospitalization was answered with question four. The research question was proposed to assess the impact of role function factors, mainly, marital status, living situation (alone or not), employment status and insurance status on 30-day HF unplanned rehospitalization. The study displayed that 22% were living alone, and when living alone the study found it to be a significant predictor for 30-day HF unplanned rehospitalization. Thirty day unplanned rehospitalization was lower for HF patients living alone compared to HF patients who lived with someone, similar to a previous study that showed living with family increased the risk of HF rehospitalization (Hamner & Ellison, 2005). This result could be interpreted as if the patient lives alone, they tend to wait before they seek help. Often

persons living in the same house, such as family members or spouses, encourage persons to seek treatment for symptoms immediately. The results of this study was similar to the results from Roe-Prior (2007) study in that unmarried/single HF patients were at higher risk for rehospitalization than married persons. The level of social support has shown influence on health outcomes, such as 30-day rehospitalization. The findings related to employment aligns with findings from another study that showed unemployment was significantly associated with an increased chances for 30-day HF unplanned rehospitalization (Tsuchihashi et al., 2001). For the final role function factor, findings showed that individuals with insurance were less likely than individuals without health insurance to experience 30-day unplanned rehospitalization.

These results indicate that 30-day HF unplanned rehospitalization could be influenced by non-clinical variables, such as living status. Also, the role function factors should be added to the list of factors that are addressed when developing a plan of care and treatment in an attempt to reduce HF rehospitalization.

The final research question was an examination of the combined impact of the multiple types of factors on 30-day HF unplanned rehospitalization. Findings showed significant relationships between the number of previous hospitalizations, differences in weight between discharge and admission, the use of angiotensin converting enzymes inhibitor, the use of antidepressants, not married and 30-day unplanned rehospitalization. Losing greater amounts of weight between admission and discharge, use of angiotensin converting enzymes and antidepressants, as well as being married were related to lower risk of rehospitalization, with consideration of the other factors. An increase in the

number of hospitalization was associated with a higher odds of 30-day HF unplanned rehospitalization.

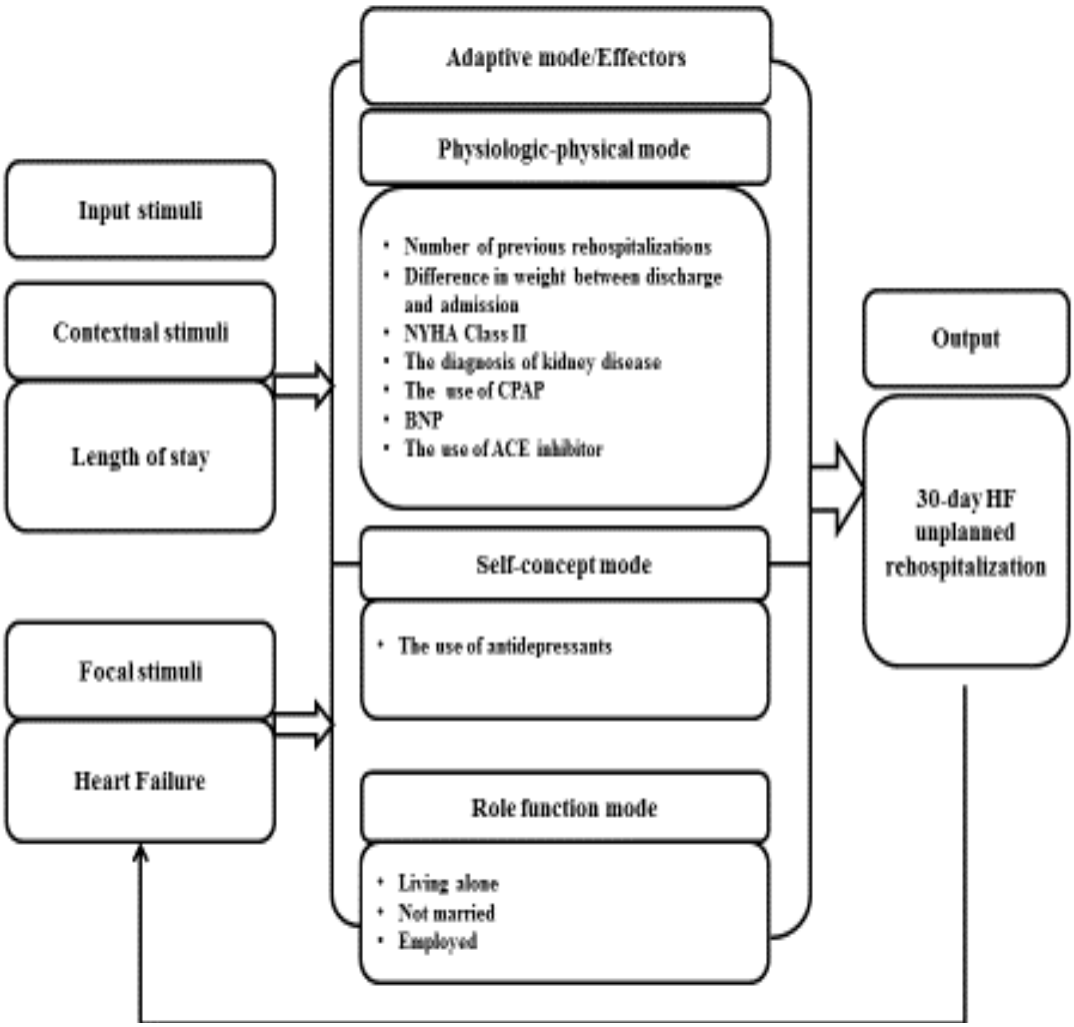
## Conclusions

State of science is that nursing is moving to more interventions, thus we need to understand more comprehensively why patients are rehospitalized. The findings showed that there are several factors and variables associated with 30-day HF unplanned rehospitalizations. The factors that were significantly associated and predicted 30-day HF unplanned rehospitalizations included, contextual factor patient characteristics, such as, the length of stay, New York heart failure classification (class II), body mass index, number of previous hospitalizations, and difference in weight between discharge and admission. For the physiological factors of cardiovascular and non-cardiovascular conditions, the diagnosis of chronic kidney disease, the use of CPAP were significantly associated with 30-day. Furthermore, physiological factors of laboratory values, such as, hemoglobin on admission and upon discharge, hematocrit at discharge, creatinine on admission and upon discharge, blood urea nitrogen on admission and upon discharge, B-type Natriuretic peptide were found significantly associated with 30-day unplanned rehospitalization. The final group of physiological factors showed the use of angiotensin converting enzymes inhibitor, and the use of antidepressants were among the variables that significantly predicted 30-day HF rehospitalization. Finally, role function factors of living situation, marital status, employment status, and insurance statues were found to predict HF rehospitalization.

The RAM was useful in developing the conceptual model for the study. The model was largely supported by the findings. Factors in each of the three adaptive modes and the contextual stimuli influenced 30-day unplanned rehospitalization among this sample of HF patients using electronic medical records (Figure. 2). The factors were similar to those found in previous studies. The physiological mode, which receives the most attention during hospitalization, was only one mode that contributed to understanding 30-day unplanned rehospitalization. Specific medication categories, diagnoses, living situations, social support and economics, as well as individual characteristics, influenced 30-day unplanned rehospitalization both individually and collectively.

Families and communities influenced the occurrence of an unplanned hospitalization, especially among the HF patients. Many of these factors for adaptation are within the control of the patient, while others are in the control of health professionals. Therefore, there is a critical need to develop an assessment tool, implement interventions and provide early identification of risk.

Figure 2. Summary for Factors that Influence 30-Day Unplanned Rehospitalization




## Implications

### Practice

This study has assisted in identifying the factors and variables associated with 30-day unplanned rehospitalization. These findings will help primary care providers, nurse, and hospital administration to develop the interventions and discharge plans to decrease the occurrence of 30-day unplanned rehospitalization among HF patients. Primary care

providers are encouraged to review, patient's family history, and past medical history and laboratory values on a daily bases and address the abnormal values. In addition, health care providers need to reconcile patient's medications at discharge, and make sure patients are discharged home on ACE inhibitors to reduce their chances for 30-day unplanned rehospitalizations, and antidepressants if they are diagnosed with depression. These recommendations are similar to those provided by the American Heart Association and the American College of Cardiology (Yancy et al., 2013).

Nurses as case managers are in a key position to evaluate the factors associated with 30-day HF unplanned rehospitalization. Those factors include the living situation, insurance status, marital status, weight lost during hospitalization, number of previous hospitalizations, and the compliance with CPAP. This information will help in developing care plans that will reduce 30-day rehospitalization. Assessment by nurse case managers should include living situation and ensuring patients have social support in place to reduce chances for rehospitalization. Including families in community and hospital care and education can be used for this purpose. Furthermore, working with uninsured patients and providing information that will help them sign up for insurance, or enroll them in programs designated to help HF patients with medication and follow up appointments with their primary care provider. Collaborations with social workers can provide this type of information and assistance. The use of CPAP reduces the work of breathing; consequently, decrease the chances for respiratory distress associated with HF. The reduction in the chances of respiratory distress will decrease the chance for rehospitalization. The education of HF patients regarding the use of medical equipment,

such as, CPAP is vital to increase patients' compliance, and show HF patients how to use it properly.

**Education**

HF patients are in a unique position. They have a chronic condition, with several symptoms, and multiple medications prescribed. In addition, HF patients experience self-management challenges to follow certain diets and specific physical activity recommendations. The role of the nurse or HF educator is to educate HF patients on all aspects, such as, medication adherence, activity and exercise, diet, monitoring fluid intake and weight, and to keep their follow up appointments with health care providers. Nurses and educators can work with HF patient to improve their adherence to treatment and encourage them to seek help when needed (Coby et al., 2009). This study has provided the areas that nurses and HF educators need to focus on in an effort to increase patient's understanding, compliance, and consequently help in reducing HF rehospitalization. Nurses are in a key position to participate in reducing the rates of 30-day unplanned rehospitalization. Their roles are essential in saving health care system from spending billions of dollars and increasing direct spending on health promotion and disease prevention, as well as alleviating family and community burden and improving quality of life for HF patients.

The education of HF patients' needs to address a variety of aspects. These areas can be addressed best by a qualified nurse, with a strong understanding of the predictors of HF. There are multiple programs available that aim to increase the understanding of this phenomenon, in addition, focus on educating HF patients on diet, activity level and

exercise, medication's compliance, daily weight monitoring with keeping records, and the need to have family involvement in the process of caring for HF patients. HF educators may utilize the results of this study and develop programs that emphasize the importance of compliance to prescribed medications, such as, ACE inhibitors, and antidepressants. Furthermore, building other programs that focus on importance of adherence to cardiac diet (low sodium level) monitoring weight and recording it daily. May provide additional achievement of positive outcomes for HF patients, including reduced likelihood of 30-day unplanned rehospitalization.

**Research**

The phenomenon has been addressed extensively in the current literature. Findings from this study align with the results of previous research studies. The current study has provided an extensive awareness in the understanding of 30-day HF unplanned rehospitalization. The results of this study indicated that different variables are associated or predict 30-day HF unplanned rehospitalization. Each factor identified in this study to be significantly associated with HF is an important area for future research. The results of this study such as, the length of stay, is important to focus on by other researchers. The length of stay was described in this study only as predictor, however, the causes for increase the length of stay could be evaluated separately, and recommendations to address the increase in the time spent at the hospital need to be evaluated further. Moreover, the net weight change during hospitalization was identified as a factor that influenced 30-day HF rehospitalizations. The exact amount of fluids HF patient's need to lose before discharge is an area that can be studied further with a different populations or

different sample size. In addition, preventive efforts and their effect on maintaining fluid balance among HF patients should be evaluated through formal study. The BMI was found to be associated to an increased chance for 30-day HF unplanned rehospitalization; therefore, body mass index could be evaluated by focusing on those with higher BMI, which might be related to increase in weight. Number of previous hospitalization was identified as a factor associated with HF rehospitalization. The number of and time frame for hospitalizations is an area for research. As mentioned in chapters 1 and 2, differing time periods for HF readmission have been used in previous research. The initiation of the CMS rule regarding 30-day readmission should take precedence in future research. The living situation, and the level of family support, and the type of insurance could be investigated more in research. Future research will require larger sample sizes to conduct studies with additional factors within the adaptive modes. Moreover, researchers are encouraged to use other complex analyses, such as, cluster analysis to validate the findings of the current study, and provide additional understanding of 30-day HF unplanned rehospitalizations.

## Limitations

A number of limitations exist in the study that limits the generalizability of the findings. A larger sample is needed to validate the findings further. The type and definition of data variables were constrained by the available EMR data. Additional definitions and availability of data points, such as, the number of participants that were not working due to disability or retirement may provide further understanding of 30-day HF unplanned rehospitalization. Data were obtained from a local hospital in a small

urban area, thus the results may not be reflective of all HF patient outcomes. In addition, there were some challenges because not all data points were available for all patient records.

## Summary

Thirty-day HF rehospitalization has been an area of interest for researchers in this field for the past few decades. Thirty-day HF unplanned rehospitalization has been, and continues to be the focus of health care providers, nurses, researchers and payers. The interest in decreasing the rates of HF 30-day unplanned rehospitalization remains a priority for government, health care systems, payers, families and communities. The results of previous reports and interventions targeting this phenomenon have not been consistent in producing the outcomes desired. Identifying different factors that influence 30-day unplanned rehospitalization in HF was the focus of this study to provide a basis for developing tailored interventions and a successful discharge plan that focused on specific patients' needs. This study aimed to identify the factors that influence 30-day HF unplanned rehospitalization.

This study was guided by Roy adaption model using variables that represented the contextual stimuli and three adaptive modes. Two hundred and seventy electronic medical records were reviewed and used based on the inclusion and exclusion criteria. Several factors including patient's characteristics, physiological factors, psychological factors, and role function factors were associated with 30-day HF unplanned rehospitalization. This study was similar to previous reports in most cases. Thus, the conceptual model was useful in providing a better understanding of 30-day

rehospitalization among this sample of HF patients. Findings provide a basis on which to plan care while in the hospital, upon discharge and while at home. Providers, professionals, families and communities can use the findings to strengthen self-care, monitoring of diet, medications and weight, plan for post hospital follow up and regular follow up due to the nature of HF. Future research needed in the several areas.

## REFERENCES


Afzal, A., Ananthasubramaniam, K., Sharma, N., al-Malki, Q., Ali, A. S., Jacobsen, G., & Jafri, S. M. (1999). Racial differences in patients with heart failure. *Clinical Cardiology*, *22*(12), 791-794.

Agoston, I., Cameron, C. S., Yao, D., Dela Rosa, A., Mann, D. L., & Deswal, A. (2004). Comparison of outcomes of white versus black patients hospitalized with heart failure and preserved ejection fraction. *American Journal of Cardiology, 94*(8), 1003-1007. doi: 10.1016/j.amjcard.2004.06.054

Ahmed, A., Thornton, P., Perry, G. J., Allman, R. M., & DeLong, J. F. (2004). Impact of atrial fibrillation on mortality and readmission in older adults hospitalized with heart failure. *European Journal of Heart Failure, 6*(4), 421-426. doi: 10.1016/j.ejheart.2003.11.011

Akyil, R., & Ergüney, S. (2013). Roy's adaptation model-guided education for adaptation to chronic obstructive pulmonary disease. *Journal of Advanced Nursing, 69*(5), 1063-1075. doi: 10.1111/j.1365-2648.2012.06093.x

Albert, N., & Zeller, R. (2009). Depressed patients understand heart failure prognosis but not how to control it. *Heart & Lung: The Journal of Acute and Critical Care, 38*(5), 382-391. doi: 10.1016/j.hrtlng.2008.10.007

Alla, F., Al-Hindi, A. Y., Lee, C. R., Schwartz, T. A., Patterson, J. H., & Adams, K. F., Jr. (2007). Relation of sex to morbidity and mortality in patients with heart failure and reduced or preserved left ventricular ejection fraction. *American Heart Journal, 153*(6), 1074-1080. doi: 10.1016/j.ahj.2007.03.016

Allen, A., Smoyer Tomic, E., Smith, M., Wilson, L., & Agodoa, I. (2012). Rates and predictors of 30-day readmission among commercially insured and Medicaid-enrolled patients hospitalized with systolic heart failure. *Circulation: Heart Failure, 5*(6), 672-679. doi: 10.1161/circheartfailure.112.967356

Amarasingham, R., Moore, B. J., Tabak, Y. P., Drazner, M. H., Clark, C. A., Zhang, S., . . . Halm, E. A. (2010). An Automated Model to Identify Heart Failure Patients at Risk for 30-Day Readmission or Death Using Electronic Medical Record Data. *Medical Care, 48*(11), 981-988. doi: 10.1097/MLR.0b013e3181ef60d9

Anand, R. G., Ventura, H. O., & Mehra, M. R. (2007). Is heart failure more prevalent in patients with peripheral arterial disease? A meta-analysis. *Congestive Heart Failure, 13*(6), 319-322.

Andrews, H. A., & Roy, C. (1991). *The Roy adaptation model: the definitive statement*. Norwalk, Conn.: Appleton & Lange.

Aranda, J. M., Johnson, J. W., & Conti, J. B. (2009). Current trends in heart failure readmission rates: analysis of medicare data. *Clinical Cardiology, 32*(1), 47-52. doi: 10.1002/clc.20453

Araujo, J. P., Lourenco, P., Azevedo, A., Frioes, F., Rocha-Goncalves, F., Ferreira, A., & Bettencourt, P. (2009). Prognostic value of high-sensitivity C-reactive protein in heart failure: a systematic review. *Journal of Cardiac Failure, 15*(3), 256-266. doi: 10.1016/j.cardfail.2008.10.030

Babayan, Z. V., McNamara, R. L., Nagajothi, N., Kasper, E. K., Armenian, H. K., Powe, N. R., . . . Lima, J. A. (2003). Predictors of cause-specific hospital readmission in patients with heart failure. *Clinical Cardiology, 26*(9), 411-418.

Bahrami, H., Kronmal, R., Bluemke, D. A., Olson, J., Shea, S., Liu, K., . . . Lima, J. A. (2008). Differences in the incidence of congestive heart failure by ethnicity: the multi-ethnic study of atherosclerosis. *Archives of Internal Medicine, 168*(19), 2138-2145. doi: 10.1001/archinte.168.19.2138

Bakan, G., & Akyol, A. D. (2008). Theory-guided interventions for adaptation to heart failure. *Journal of Advanced Nursing, 61*(6), 596-608. doi: 10.1111/j.1365-2648.2007.04489.x

Barsheshet, A., Shotan, A., Cohen, E., Garty, M., Goldenberg, I., Sandach, A., . . . Gottlieb, S. (2010). Predictors of long-term (4-year) mortality in elderly and young patients with acute heart failure. *European Journal of Heart Failure, 12*(8), 833-840. doi: 10.1093/eurjhf/hfq079

Berry, C., Brett, M., Stevenson, K., McMurray, J. J., & Norrie, J. (2008). Nature and prognostic importance of abnormal glucose tolerance and diabetes in acute heart failure. *Heart, 94*(3), 296-304. doi: 10.1136/hrt.2006.110999

Berry, C., Hogg, K., Norrie, J., Stevenson, K., Brett, M., & McMurray, J. (2005). Heart failure with preserved left ventricular systolic function: a hospital cohort study. *Heart, 91*(7), 907-913. doi: 10.1136/hrt.2004.041996

Berry, C., Norrie, J., Hogg, K., Brett, M., Stevenson, K., & McMurray, J. J. (2006). The prevalence, nature, and importance of hematologic abnormalities in heart failure. *American Heart Journal, 151*(6), 1313-1321. doi: 10.1016/j.ahj.2005.07.032

Bettencourt, P., Azevedo, A., Fonseca, L., Araujo, J. P., Ferreira, S., Almeida, R., . . . Ferreira, A. (2007). Prognosis of decompensated heart failure patients with preserved systolic function is predicted by NT-proBNP variations during hospitalization. *International Journal of Cardiology, 117*(1), 75-79. doi: 10.1016/j.ijcard.2006.06.004

Bettencourt, P., Azevedo, A., Pimenta, J., Frioes, F., Ferreira, S., & Ferreira, A. (2004). N-terminal-pro-brain natriuretic peptide predicts outcome after hospital discharge in heart failure patients. *Circulation, 110*(15), 2168-2174. doi: 10.1161/01.cir.0000144310.04433.be

Bilheimer, L. T., & Klein, R. J. (2010). Data and measurement issues in the analysis of health disparities. *Health services research, 45*(5), 1489-1507.

Bilheimer, L. T., & Sisk, J. E. (2008). Collecting adequate data on racial and ethnic disparities in health: The challenges continue. *Health Affairs, 27*(2), 383-391.

Blackledge, H. M., Newton, J., & Squire, I. B. (2003). Prognosis for South Asian and white patients newly admitted to hospital with heart failure in the United Kingdom: historical cohort study. *British Medical Journal, 327*(7414), 526-531. doi: 10.1136/bmj.327.7414.526

Braunstein, B., Anderson, F., Gerstenblith, G., Weller, W., Niefeld, M., Herbert, R., & Wu, A. W. (2003). Noncardiac comorbidity increases preventable hospitalizations and mortality among Medicare beneficiaries with chronic heart failure. *Journal of American College of Cardiology, 42*(7), 1226-1233.

Brophy, J. M., Dagenais, G. R., McSherry, F., Williford, W., & Yusuf, S. (2004). A multivariate model for predicting mortality in patients with heart failure and systolic dysfunction. *American Journal of Medicine, 116*(5), 300-304. doi: 10.1016/j.amjmed.2003.09.035

Bueno, H., Ross, J. S., Wang, Y., Chen, J., Vidan, M. T., Normand, S. L., . . . Krumholz, H. M. (2010). Trends in length of stay and short-term outcomes among Medicare patients hospitalized for heart failure, 1993-2006. *The Journal of the American Medical Association, 303*(21), 2141-2147. doi: 10.1001/jama.2010.748

Bueno, H., Ross, J. S., Wang, Y., Chen, J., Vidán, M. T., Normand, S.-L. T., . . . Krumholz, H. M. (2010). Trends in length of stay and short-term outcomes among Medicare Patients Hospitalized for Heart Failure: 1993–2008. *The journal of the American Medical Association, 303*(21), 2141-2147. doi: 10.1001/jama.2010.748

Carmen Van Voorhis, & Morgan, B. L. (2007). Understanding power and rules of thumb for determining sample sizes. *Tutorials in Quantitative Methods for Psychology, 3*(2).

Centers for Medicare & Medicaid Services. (2014). *Readmissions Reduction Program* Retrieved from http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Readmissions-Reduction-Program.html.

Chen, J., Normand, S. T., Wang, Y., & Krumholz, H. M. (2011). National and regional trends in heart failure hospitalization and mortality rates for medicare beneficiaries, 1998-2008. *The journal of the American Medical Association, 306*(15), 1669-1678. doi: 10.1001/jama.2011.1474

Cheng, V., Kazanagra, R., Garcia, A., Lenert, L., Krishnaswamy, P., Gardetto, N., . . . Maisel, A. (2001). A rapid bedside test for B-type peptide predicts treatment outcomes in patients admitted for decompensated heart failure: a pilot study. *Journal of American College of Cardiology, 37*(2), 386-391.

Chiung-Zuan, C., & Jun-Jack, C. (2007). Congestive Heart Failure in the Elderly. *International Journal of Gerontology, 1*, 143-152. doi: 10.1016/s1873-9598(08)70038-3

Coby, A., Marie-Louise, L., & Tiny, J. (2009). Issues in heart failure: Reasons for readmission in heart failure: Perspectives of patients, caregivers, cardiologists, and heart failure nurses. *Heart & Lung - The Journal of Acute and Critical Care, 38*, 427-434. doi: 10.1016/j.hrtlng.2008.12.002

Copeland, L. A., Berg, G. D., Johnson, D. M., & Bauer, R. L. (2010). An Intervention for VA Patients with Congestive Heart Failure. *American Journal of Managed Care, 16*(3), 158-165.

Copstead, L. E., & Banasik, J. L. (2005). *Pathophysiology*. St. Louis, Mo.: Elsevier Saunders.

Corrao, G., Ghirardi, A., Ibrahim, B., Merlino, L., & Maggioni, A. P. (2015). Short- and long-term mortality and hospital readmissions among patients with new hospitalization for heart failure: A population-based investigation from Italy. *International Journal of Cardiology, 181*, 81-87. doi: http://dx.doi.org/10.1016/j.ijcard.2014.12.004

Curtis, L. H., Greiner, M. A., Hammill, B. G., Schulman, K. A., Kramer, J. M., Whellan, D. J., & Hernandez, A. F. (2008). Early and long-term outcomes of heart failure in elderly persons, 2001-2005. *Archives of Internal Medicine, 168*(22), 2481-2488.

Darze, E. S., Latado, A. L., Guimaraes, A. G., Guedes, R. A., Santos, A. B., de Moura, S. S., & Passos, L. C. (2007). Acute pulmonary embolism is an independent predictor of adverse events in severe decompensated heart failure patients. *Chest, 131*(6), 1838-1843. doi: 10.1378/chest.06-2077

Daviglus, M. L., Lloyd-Jones, D. M., & Pirzada, A. (2006). Preventing cardiovascular disease in the 21st century: therapeutic and preventive implications of current evidence. *American Journal of Cardiovascular Drugs*, *6*(2), 87-101.

De Lusignan, S. (2001). Compliance and effectiveness of 1 year's home telemonitoring. The report of a pilot study of patients with chronic heart failure. *European Journal of Heart Failure, 3*(6), 723-730.

Del Carlo, C. H., Pereira-Barretto, A. C., Cassaro-Strunz, C., Latorre Mdo, R., & Ramires, J. A. (2004). Serial measure of cardiac troponin T levels for prediction of clinical events in decompensated heart failure. *Journal of Cardiac Failure, 10*(1), 43-48.

Department of Social Services. (2013). *State of the county health report* Retrieved from http://www.gastongov.com/departments/health-and-human-services/public-health-division/community-health-data.

Dobratz, M. C. (2011). Toward Development of a Middle-Range Theory of Psychological Adaptation in Death and Dying. *Nursing Science Quarterly, 24*(4), 370-376. doi: 10.1177/0894318411419212

Dunlay, S. M., Redfield, M. M., Weston, S. A., Therneau, T. M., Hall Long, K., Shah, N. D., & Roger, V. L. (2009). Hospitalizations after heart failure diagnosis a community perspective. *Journal of the American College of Cardiology, 54*(18), 1695-1702. doi: 10.1016/j.jacc.2009.08.019

Eastwood, C. A., Howlett, J. G., King-Shier, K. M., McAlister, F. A., Ezekowitz, J. A., & Quan, H. (2014). Determinants of early readmission after hospitalization for heart failure. *Canadian Journal of Cardiology, 30*(6), 612-618. doi: 10.1016/j.cjca.2014.02.017

Esposito, D., Bagchi, A. D., Verdier, J. M., Bencio, D. S., & Kim, M. S. (2009). Medicaid beneficiaries with congestive heart failure: association of medication adherence with healthcare use and costs. *American Journal of Managed Care, 15*(7), 437-445.

Evangelista, L. S., Doering, L. V., & Dracup, K. (2000). Usefulness of a history of tobacco and alcohol use in predicting multiple heart failure readmissions among veterans. *American Journal of Cardiology, 86*(12), 1339-1342.

Ezekowitz, J. A., Bakal, J. A., Kaul, P., Westerhout, C. M., & Armstrong, P. W. (2008). Acute heart failure in the emergency department: short and long-term outcomes of elderly patients with heart failure. *European Journal of Heart Fail, 10*(3), 308-314. doi: 10.1016/j.ejheart.2008.01.014

Fátima, R., Karen, E. J., Lenny, L., Fidencio, S., & Ashish, K. J. (2011). Clinical Investigation: Readmission rates for Hispanic Medicare beneficiaries with heart failure and acute myocardial infarction. *American Heart Journal, 162*, 254-261.e253. doi: 10.1016/j.ahj.2011.05.009

Felker, G. M., Adams, K. F., Jr., Gattis, W. A., & O'Connor, C. M. (2004). Anemia as a risk factor and therapeutic target in heart failure. *Journal of the American College Cardiology, 44*(5), 959-966. doi: 10.1016/j.jacc.2004.05.070

Felker, G. M., Gattis, W. A., Leimberger, J. D., Adams, K. F., Cuffe, M. S., Gheorghiade, M., & O'Connor, C. M. (2003). Usefulness of anemia as a predictor of death and rehospitalization in patients with decompensated heart failure. *American Journal of Cardiology, 92*(5), 625-628.

Feola, M., Aspromonte, N., Milani, L., Bobbio, M., Bardellotto, S., Barro, S., . . . Valle, R. (2008). Plasma brain natriuretic peptide predicts short-term clinical outcome in heart failure patients with restrictive filling pattern. *Journal of Cardiac Failure, 14*(5), 420-425. doi: 10.1016/j.cardfail.2008.01.013

Ferreira, S., Almeida, R., Guerrero, H., Lourenco-Ferreira, S., Fonseca, L., Rocha, R., . . . Bettencourt, P. (2007). Prognosis of decompensated heart failure: role of NT-proBNP. *Revista portuguesa de Cardiologia, 26*(5), 535-545.

Fonarow, C., Abraham, T., Albert, N. M., Stough, W. G., Gheorghiade, M., Greenberg, B. H., . . . Young, J. B. (2007). Association between performance measures and clinical outcomes for patients hospitalized with heart failure. *The Journal of the American Medical Association, 297*(1), 61-70. doi: 10.1001/jama.297.1.61

Fonarow, G. C., Stough, W. G., Abraham, W. T., Albert, N. M., Gheorghiade, M., Greenberg, B. H., . . . Young, J. B. (2007). Characteristics, Treatments, and Outcomes of Patients With Preserved Systolic Function Hospitalized for Heart Failure: A Report From the OPTIMIZE-HF Registry. *Journal of the American College of Cardiology, 50*(8), 768-777. doi: http://dx.doi.org/10.1016/j.jacc.2007.04.064

Fonarow, G. C., Stough, W. G., Abraham, W. T., Albert, N. M., Gheorghiade, M., Greenberg, B. H., . . . Young, J. B. (2007). Characteristics, treatments, and outcomes of patients with preserved systolic function hospitalized for heart failure: a report from the OPTIMIZE-HF Registry. *Journal of the American College of Cardiology, 50*(8), 768-777. doi: 10.1016/j.jacc.2007.04.064

Frazier, C. G., Alexander, K. P., Newby, L. K., Anderson, S., Iverson, E., Packer, M., . . . Douglas, P. S. (2007). Associations of gender and etiology with outcomes in heart failure with systolic dysfunction: a pooled analysis of 5 randomized control trials. *Journal of the American College of Cardiology, 49*(13), 1450-1458. doi: 10.1016/j.jacc.2006.11.041

Friedman, B., & Basu, J. (2004). The Rate and Cost of Hospital Readmissions for Preventable Conditions. *Medical Care Research and Review, 61*(2), 225-240.

Gackowski, A., Isnard, R., Golmard, J. L., Pousset, F., Carayon, A., Montalescot, G., . . . Komajda, M. (2004). Comparison of echocardiography and plasma B-type natriuretic peptide for monitoring the response to treatment in acute heart failure. *European Heart Journal, 25*(20), 1788-1796. doi: 10.1016/j.ehj.2004.07.038

Gambassi, G., Agha, S. A., Sui, X., Yancy, C. W., Butler, J., Giamouzis, G., . . . Ahmed, A. (2008). Race and the natural history of chronic heart failure: a propensity-matched study. *Journal of Cardiac Failure, 14*(5), 373-378. doi: 10.1016/j.cardfail.2008.02.004

Gerstein, H. C., Swedberg, K., Carlsson, J., McMurray, J. J., Michelson, E. L., Olofsson, B., . . . Yusuf, S. (2008). The hemoglobin A1c level as a progressive risk factor for cardiovascular death, hospitalization for heart failure, or death in patients with chronic heart failure: an analysis of the Candesartan in Heart failure: Assessment of Reduction in Mortality and Morbidity (CHARM) program. *Archives of Internal Medicine journal, 168*(15), 1699-1704. doi: 10.1001/archinte.168.15.1699

Gheorghiade, M., Abraham, W. T., Albert, N. M., Gattis Stough, W., Greenberg, B. H., O'Connor, C. M., . . . Fonarow, G. C. (2007). Relationship between admission serum sodium concentration and clinical outcomes in patients hospitalized for heart failure: an analysis from the OPTIMIZE-HF registry. *European Heart Journal, 28*(8), 980-988. doi: 10.1093/eurheartj/ehl542

Gheorghiade, M., Vaduganathan, M., Fonarow, G. C., & Bonow, R. O. (2013). Rehospitalization for Heart FailureProblems and Perspectives. *Journal of the American College of Cardiology, 61*(4), 391-403. doi: 10.1016/j.jacc.2012.09.038

Giamouzis, G., Kalogeropoulos, A., Georgiopoulou, V., Laskar, S., Smith, A. L., Dunbar, S., . . . Butler, J. (2011). Hospitalization epidemic in patients with heart failure: risk factors, risk prediction, knowledge gaps, and future directions. *Journal of Cardiac Failure, 17*(1), 54-75. doi: 10.1016/j.cardfail.2010.08.010

Giamouzis, G., Kalogeropoulos, A. P., Georgiopoulou, V. V., Agha, S. A., Rashad, M. A., Laskar, S. R., . . . Butler, J. (2009). Incremental value of renal function in risk prediction with the Seattle Heart Failure Model. *American Heart Journal, 157*(2), 299-305. doi: 10.1016/j.ahj.2008.10.007

Go, A. S., Mozaffarian, D., Roger, V. L., Benjamin, E. J., Berry, J. D., Blaha, M. J., . . . Turner, M. B. (2014). Heart Disease and Stroke Statistics—2014 Update: A Report From the American Heart Association. *Circulation, 129*(3), e28-e292. doi: 10.1161/01.cir.0000441139.02102.80

Greenberg, B. H., Abraham, W. T., Albert, N. M., Chiswell, K., Clare, R., Stough, W. G., . . . Fonarow, G. C. (2007). Influence of diabetes on characteristics and outcomes in patients hospitalized with heart failure: a report from the Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients with Heart Failure (OPTIMIZE-HF). *American Heart Journal, 154*(2), 277 e271-278. doi: 10.1016/j.ahj.2007.05.001

Hägglund, L., Boman, K., Lundman, B., & Brulin, C. (2008). Depression among elderly people with and without heart failure, managed in a primary healthcare setting. *Scandinavian Journal of Caring Sciences, 22*(3), 376-382. doi: 10.1111/j.1471-6712.2007.00540.x

Hamner, J. B., & Ellison, K. J. (2005). Predictors of hospital readmission after discharge in patients with congestive heart failure. *Heart & Lung: The Journal of Acute and Critical Care, 34*(4), 231-239. doi: 10.1016/j.hrtlng.2005.01.001

Harjai, K. J., Nunez, E., Turgut, T., Shah, M. P., Humphrey, J. S., Newman, J., . . . Ventura, H. O. (1999). The independent effects of left ventricular ejection fraction on short-term outcomes and resource utilization following hospitalization for heart failure. *Clinical Cardiology, 22*(3), 184-190.

Harjai, K. J., Thompson, H. W., Turgut, T., & Shah, M. (2001). Simple clinical variables are markers of the propensity for readmission in patients hospitalized with heart failure. *American Journal of Cardiology, 87*(2), 234-237, A239.

Heidenreich, P. A., Albert, N. M., Allen, L. A., Bluemke, D. A., Butler, J., Fonarow, G. C., . . . Trogdon, J. G. (2013). Forecasting the impact of heart failure in the United States: a policy statement from the American Heart Association. *Circulation: Heart Failure, 6*(3), 606-619. doi: 10.1161/HHF.0b013e318291329a

Hernandez, M. B., Schwartz, R. S., Asher, C. R., Navas, E. V., Totfalusi, V., Buitrago, I., . . . Novaro, G. M. (2013). Predictors of 30-day readmission in patients hospitalized with decompensated heart failure. *Clinical Cardiology, 36*(9), 542-547. doi: 10.1002/clc.22180

Holzapfel, N., Löwe, B., Wild, B., Schellberg, D., Zugck, C., Remppis, A., . . . Müller-Tasch, T. (2009). Self-care and depression in patients with chronic heart failure. *Heart & Lung: The Journal of Acute and Critical Care, 38*(5), 392-397. doi: 10.1016/j.hrtlng.2008.11.001

Hospitalization. 2014. In *Merriam-Webster.com*. Retrieved May 8, 2014, from http://dictionary.reference.com/browse/hospitalization

Howie-Esquivel, J., & Dracup, K. (2007). Effect of gender, ethnicity, pulmonary disease, and symptom stability on rehospitalization in patients with heart failure. *American Journal of Cardiology, 100*(7), 1139-1144. doi: 10.1016/j.amjcard.2007.04.061

Hunt, S. A., Abraham, W. T., Chin, M. H., Feldman, A. M., Francis, G. S., Ganiats, T. G., . . . Yancy, C. W. (2009). 2009 Focused Update Incorporated Into the ACC/AHA 2005 Guidelines for the Diagnosis and Management of Heart Failure in Adults: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines: Developed in Collaboration With the International Society for Heart and Lung Transplantation. *Circulation, 119*(14), e391-e479. doi: 10.1161/circulationaha.109.192065

Ingrassia, J., Soucier, R., Woiciechowski, M., Cyr, P., & Crowell, R. (2015). Risk Predictors for 30 day Readmission & Length of Stay. *Journal of Cardiac Failure, 21*(8, Supplement), S120. doi: http://dx.doi.org/10.1016/j.cardfail.2015.06.345

Isbir, G. G., & Mete, S. (2010). Nursing care of nausea and vomiting in pregnancy: Roy adaptation model. *Nursing Science Quarterly*, *23*(2), 148-155. doi: 10.1177/0894318410362489

Ishii, J., Cui, W., Kitagawa, F., Kuno, T., Nakamura, Y., Naruse, H., . . . Hishida, H. (2003). Prognostic value of combination of cardiac troponin T and B-type natriuretic peptide after initiation of treatment in patients with chronic heart failure. *Clinical Chemistry*, *49*(12), 2020-2026. doi: 10.1373/clinchem.2003.021311

Jencks, S. F., Williams, M. V., & Coleman, E. A. (2009). Rehospitalizations among Patients in the Medicare Fee-for-Service Program. *New England Journal of Medicine, 360*(14), 1418-1428. doi: doi:10.1056/NEJMsa0803563

Johansson, P., Dahlström, U., & Alehagen, U. (2007). Depressive symptoms and six-year cardiovascular mortality in elderly patients with and without heart failure. *Scandinavian Cardiovascular Journal, 41*(5), 299-307. doi: 10.1080/14017430701534829

Joynt, K. E., & Jha, A. K. (2011). Who has higher readmission rates for heart failure, and why? Implications for efforts to improve care using financial incentives. *Circulation: Cardiovascular Quality and Outcomes, 4*(1), 53-59. doi: 10.1161/circoutcomes.110.950964

Kasai, T., Narui, K., Dohi, T., Yanagisawa, N., Ishiwata, S., Ohno, M., . . . Momomura, S. (2008). Prognosis of patients with heart failure and obstructive sleep apnea treated with continuous positive airway pressure. *Chest, 133*(3), 690-696. doi: 10.1378/chest.07-1901

Keenan, P. S., Normand, S.-L. T., Lin, Z., Drye, E. E., Bhat, K. R., Ross, J. S., . . . Krumholz, H. M. (2008). An Administrative Claims Measure Suitable for Profiling Hospital Performance on the Basis of 30-Day All-Cause Readmission Rates Among Patients With Heart Failure. *Circulation: Cardiovascular Quality and Outcomes, 1*(1), 29-37. doi: 10.1161/circoutcomes.108.802686

Keri, L. R., Cathleen, J. A., Galen, E. S., Ali, F. S., & Robert, M. A. (2008). Issues in cardiovascular nursing: "They diagnosed bad heart": A qualitative exploration of patients' knowledge about and experiences with heart failure. *Heart & Lung - The Journal of Acute and Critical Care, 37*, 257-265. doi: 10.1016/j.hrtlng.2007.09.001

Koitabashi, T., Inomata, T., Niwano, S., Nishii, M., Takeuchi, I., Nakano, H., . . . Izumi, T. (2005). Paroxysmal Atrial Fibrillation Coincident with Cardiac Decompensation is a Predictor of Poor Prognosis in Chronic Heart Failure. *Circulation Journal, 69*(7), 823-830. doi: 10.1253/circj.69.823

Kosiborod, M., Curtis, J. P., Wang, Y., Smith, G. L., Masoudi, F. A., Foody, J. M., . . . Krumholz, H. M. (2005). Anemia and outcomes in patients with heart failure: a study from the National Heart Care Project. *Archives of Internal Medicine, 165*(19), 2237-2244. doi: 10.1001/archinte.165.19.2237

Kosiborod, M., Smith, G. L., Radford, M. J., Foody, J. M., & Krumholz, H. M. (2003). The prognostic importance of anemia in patients with heart failure. *American Journal of Medicine, 114*(2), 112-119.

Kossovsky, M. P., Sarasin, F. P., Perneger, T. V., Chopard, P., Sigaud, P., & Gaspoz, J. (2000). Unplanned readmissions of patients with congestive heart failure: do they reflect in-hospital quality of care or patient characteristics? *American Journal of Medicine, 109*(5), 386-390.

Krumholz, H. M., Chen, Y. T., Wang, Y., Vaccarino, V., Radford, M. J., & Horwitz, R. I. (2000). Predictors of readmission among elderly survivors of admission with heart failure. *American Heart Journal, 139*(1 Pt 1), 72-77.

Krumholz, H. M., Merrill, A. R., Schone, E. M., Schreiner, G. C., Chen, J., Bradley, E. H., . . . Drye, E. E. (2009). Patterns of Hospital Performance in Acute Myocardial Infarction and Heart Failure 30-Day Mortality and Readmission. *Circulation: Cardiovascular Quality and Outcomes*. doi: 10.1161/circoutcomes.109.883256

Krumholz, H. M., Parent, E. M., Tu, N., Vaccarino, V., Wang, Y., Radford, M. J., & Hennen, J. (1997). Readmission after hospitalization for congestive heart failure among Medicare beneficiaries. *Archives of Internal Medicine, 157*(1), 99-104.

Lafata, J. E., Pladevall, M., Divine, G., Ayoub, M., & Philbin, E. F. (2004). Are there race/ethnicity differences in outpatient congestive heart failure management, hospital use, and mortality among an insured population? *Medical Care Journal, 42*(7), 680-689.

Lee, R., Chan, S. P., Chan, Y. H., Wong, J., Lau, D., & Ng, K. (2009). Impact of race on morbidity and mortality in patients with congestive heart failure: a study of the multiracial population in Singapore. *International Journal of Cardiology, 134*(3), 422-425. doi: 10.1016/j.ijcard.2007.12.107

Lee, W. Y., Capra, A. M., Jensvold, N. G., Gurwitz, J. H., & Go, A. S. (2004). Gender and risk of adverse outcomes in heart failure. *American Journal of Cardiology, 94*(9), 1147-1152. doi: 10.1016/j.amjcard.2004.07.081

Lenfant, C., Chobanian, A. V., Jones, D. W., & Roccella, E. J. (2003). Seventh report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7): resetting the hypertension sails. *Hypertension, 41*(6), 1178-1179. doi: 10.1161/01.hyp.0000075790.33892.ae

Levesque, L., Ricard, N., Ducharme, F., Duquette, A., & Bonin, J. P. (1998). Empirical verification of a theoretical model derived from the Roy adaptation model: findings from five studies. *Nursing Science Quarterly, 11*(1), 31-39.

Levy, W. C., Mozaffarian, D., Linker, D. T., Sutradhar, S. C., Anker, S. D., Cropp, A. B., . . . Packer, M. (2006). The Seattle Heart Failure Model: prediction of survival in heart failure. *Circulation, 113*(11), 1424-1433. doi: 10.1161/circulationaha.105.584102

Lindenfeld, J., Albert, N. M., Boehmer, J. P., Collins, S. P., Ezekowitz, J. A., Givertz, M. M., . . . Walsh, M. N. (2010). HFSA 2010 Comprehensive Heart Failure Practice Guideline. *Journal of Cardiac Failure, 16*(6), e1-194. doi: 10.1016/j.cardfail.2010.04.004

Lloyd-Jones, D. M., Larson, M. G., Leip, E. P., Beiser, A., D'Agostino, R. B., Kannel, W. B., . . . Levy, D. (2002). Lifetime risk for developing congestive heart failure: the Framingham Heart Study. *Circulation, 106*(24), 3068-3072.

Loehr, L. R., Rosamond, W. D., Chang, P. P., Folsom, A. R., & Chambless, L. E. (2008). Heart failure incidence and survival (from the Atherosclerosis Risk in Communities study). *American Journal of Cardiology, 101*(7), 1016-1022. doi: 10.1016/j.amjcard.2007.11.061

Lorig K, L. J. (1985). Some notions about assumptions underlying health education. *Health education quarterly, 12*(3), 231-243.

Luthi, J. C., Flanders, W. D., Burnier, M., Burnand, B., & McClellan, W. M. (January 01, 2006). Anemia and chronic kidney disease are associated with poor outcomes in heart failure patients. *BMC Nephrology, 7*.

Lutjens, L. R. J. (1991). *Callista Roy: an adaptation model*. Newbury Park, Calif.: Sage Publications.

Macchia, A., Monte, S., Pellegrini, F., Romero, M., D'Ettorre, A., Tavazzi, L., . . . Maggioni, A. P. (2008). Depression worsens outcomes in elderly patients with heart failure: An analysis of 48,117 patients in a community setting. *European Journal of Heart Failure, 10*(7), 714-721. doi: 10.1016/j.ejheart.2008.05.011

MacDonald, R., Petrie, C., Varyani, F., Ostergren, J., Michelson, E. L., Young, J. B., . . . McMurray, J. J. (2008). Impact of diabetes on outcomes in patients with low and preserved ejection fraction heart failure: an analysis of the Candesartan in Heart failure: Assessment of Reduction in Mortality and morbidity (CHARM) programme. *European Heart Journal, 29*(11), 1377-1385. doi: 10.1093/eurheartj/ehn153

Manzano, L., Escobar, C., Cleland, J. G. F., & Flather, M. (2012). Diagnosis of elderly patients with heart failure. *European Journal of Heart Failure, 14*(10), 1097-1103.

Masters, K. (2012). *Nursing theories: a framework for professional practice*. Sudbury, MA: Jones & Bartlett Learning.

Metra, M., Zaca, V., Parati, G., Agostoni, P., Bonadies, M., Ciccone, M., . . . Dei Cas, L. (2011). Cardiovascular and noncardiovascular comorbidities in patients with chronic heart failure. *Journal of Cardiovascular Medicine, 12*(2), 76-84. doi: 10.2459/JCM.0b013e32834058d1

Mielniczuk, L. M., Tsang, S. W., Desai, A. S., Nohria, A., Lewis, E. F., Fang, J. C., . . . Givertz, M. M. (2008). The association between high-dose diuretics and clinical stability in ambulatory chronic heart failure patients. *Journal of Cardiac Failure, 14*(5), 388-393. doi: 10.1016/j.cardfail.2008.01.015

Milo-Cotter, O., Cotter, G., Weatherley, B. D., Adams, K. F., Kaluski, E., Uriel, N., . . . Felker, G. M. (2008). Hyponatremia in acute heart failure is a marker of increased mortality but not when associated with hyperglycemia. *European Journal of Heart Failure, 10*(2), 196-200. doi: 10.1016/j.ejheart.2008.01.008

Moser, D., & Mann, D. (2002). Improving Outcomes in Heart Failure: It's Not Unusual Beyond Usual Care. *Circulation, 105*(24), 2810-2812. doi: 10.1161/01.cir.0000021745.45349.bb

Moser, D. K., Dickson, V., Jaarsma, T., Lee, C., Stromberg, A., & Riegel, B. (2012). Role of self-care in the patient with heart failure. *Current Cardiology Reports, 14*(3), 265-275. doi: 10.1007/s11886-012-0267-9

Moser, K., & Watkins, F. (2008). Conceptualizing Self-care in Heart Failure: A Life Course Model of Patient Characteristics. *The Journal of cardiovascular nursing, 23*(3), 205-220.

Muzzarelli, S., Leibundgut, G., Maeder, M. T., Rickli, H., Handschin, R., Gutmann, M., . . . Brunner-La Rocca, H. P. (2010). Predictors of early readmission or death in elderly patients with heart failure. *American Heart Journal, 160*(2), 308-314.

Neily, J. B., Toto, K. H., Gardner, E. B., Rame, J. E., Yancy, C. W., Sheffield, M. A., . . . Drazner, M. H. (2002). Potential contributing factors to noncompliance with dietary sodium restriction in patients with heart failure. *American Heart Journal, 143*(1), 29-33.

Niizeki, T., Takeishi, Y., Arimoto, T., Okuyama, H., Nozaki, N., Hirono, O., . . . Kubota, I. (2006). Hyperuricemia associated with high cardiac event rates in the elderly with chronic heart failure. *Journal of Cardiology, 47*(5), 219-228.

Nishio, Y., Sato, Y., Taniguchi, R., Shizuta, S., Doi, T., Morimoto, T., . . . Kita, T. (2007). Cardiac troponin T vs other biochemical markers in patients with congestive heart failure. *Circulation Journal, 71*(5), 631-635.

Norusis, M. J. (2012). *IBM SPSS statistics 19 guide to data analysis*. Upper Saddle River, N.J.: Prentice Hall.

Ofili, E. O., Mayberry, R., Alema-Mensah, E., Saleem, S., Hamirani, K., Jones, C., . . . Igho-Pemu, P. (1999). Gender differences and practice implications of risk factors for frequent hospitalization for heart failure in an urban center serving predominantly African-American patients. *American Journal of Cardiology, 83*(9), 1350-1355.

Ogah, O., Stewart, S., Falase, A. O., Akinyemi, J. O., Adegbite, G. D., Alabi, A. A., . . . Sliwa, K. (2014). Predictors of Rehospitalization in Patients Admitted With Heart Failure in Abeokuta, Nigeria: Data From the Abeokuta Heart Failure Registry. *Journal of Cardiac Failure, 20*(11), 833-840. doi: http://dx.doi.org/10.1016/j.cardfail.2014.08.012

Opasich, C., De Feo, S., Ambrosio, G. A., Bellis, P., Di Lenarda, A., Di Tano, G., . . . Maggioni, A. P. (2004). The 'real' woman with heart failure. Impact of sex on current in-hospital management of heart failure by cardiologists and internists. *European Journal of Heart Failure, 6*(6), 769-779. doi: 10.1016/j.ejheart.2003.11.021

P. Henderson, J. F., and Q. Edwards. . (2003). Coping strategies among African-American women with breast cancer. *Southern Online Journal of Nursing Research. 4.*

Peduzzi, P., Concato, J., Kemper, E., Holford, T. R., & Feinstein, A. R. (1996). A simulation study of the number of events per variable in logistic regression analysis. *Journal of Clinical Epidemiology, 49*(12), 1373-1379.

Perna, E. R., Macin, S. M., Cimbaro Canella, J. P., Alvarenga, P. M., Rios, N. G., Pantich, R., . . . Medina, F. (2005). Minor myocardial damage detected by troponin T is a powerful predictor of long-term prognosis in patients with acute decompensated heart failure. *International Journal of Cardiology, 99*(2), 253-261. doi: 10.1016/j.ijcard.2004.01.017

Pernenkil, R., Vinson, J. M., Shah, A. S., Beckham, V., Wittenberg, C., & Rich, M. W. (1997). Course and prognosis in patients > or = 70 years of age with congestive heart failure and normal versus abnormal left ventricular ejection fraction. *Americana Journal of Cardiology, 79*(2), 216-219.

Perrett, S. E., & Biley, F. C. (2013). A Roy Model Study of Adapting to Being HIV Positive. *Nursing Science Quarterly, 26*(4), 337-343. doi: 10.1177/0894318413500310

Philbin, E. F., & DiSalvo, T. G. (1998). Influence of race and gender on care process, resource use, and hospital-based outcomes in congestive heart failure. *American Journal of Cardiology, 82*(1), 76-81.

Philbin, F., Dec, G. W., Jenkins, P. L., & DiSalvo, T. G. (2001). Socioeconomic status as an independent risk factor for hospital readmission for heart failure. *American Journal of Cardiology, 87*(12), 1367-1371. doi: http://dx.doi.org/10.1016/S0002-9149(01)01554-5

Phillips, K. D. (2011). Conceptual Development of an Instrument to Measure the Internalized Stigma of AIDS Based on the Roy Adaptation Model. *Nursing Science Quarterly, 24*(4), 306-310. doi: 10.1177/0894318411419222

Pimenta, J. M., Almeida, R., Araujo, J. P., Azevedo, A., Frioes, F., Rocha-Goncalves, F., . . . Bettencourt, P. (2007). Amino terminal B-type natriuretic peptide, renal function, and prognosis in acute heart failure: a hospital cohort study. *Journal of Cardiac Failure, 13*(4), 275-280. doi: 10.1016/j.cardfail.2007.01.001

Poirier, P. (2007). Factors affecting performance of usual activities during radiation therapy. *Oncology Nursing Forum, 34*(4), 827-834. doi: 10.1188/07.onf.827-834

Polit, D. F., & Beck, C. T. (2012). *Nursing research: generating and assessing evidence for nursing practice*. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Pollock, M. A., Amankwaa, L. C., & Amankwaa, A. A. (2005). First-Time Fathers and Stressors in the Postpartum Period. *The Journal of Perinatal Education, 14*(2), 19-25. doi: 10.1624/105812405X44682

Posmontier, B. (2008). Functional status outcomes in mothers with and without postpartum depression. *Journal of Midwifery & Women's Health, 53*(4), 310-318. doi: 10.1016/j.jmwh.2008.02.016

Prasun, M. A., Verhulst, S., Weller-Summers, M., Baur, K., & Nallamothu, N. (2013). 30-Day Readmission Predictors of Patients Presenting to a Nurse-Led Heart Failure (HF) Disease Management Program. *Heart & Lung: The Journal of Acute and Critical Care, 42*(4), 296-297. doi: http://dx.doi.org/10.1016/j.hrtlng.2013.06.023

Pubmed. (2014). Physiological phenomena. Retrieved 12/19/2014 http://www.ncbi.nlm.nih.gov/mesh/68010829

Pubmed. (2014). Psychological phenomena. Retrieved 12/19/2014 http://www.ncbi.nlm.nih.gov/mesh/?term=psychological

Rambo, B. J. (1984). *Adaptation nursing: assessment & intervention*. Philadelphia: Saunders.

Ramini, S. K., Brown, R., & Buckner, E. B. (2008). Embracing changes: adaptation by adolescents with cancer. *Pediatric Nursing, 34*(1), 72-79.

Randell, B., Tedrow, M. P., & Van Landingham, J. (1982). *Adaptation nursing: the Roy conceptual model applied*. St. Louis: C.V. Mosby Co.

Rathore, S. S., Foody, J. M., Wang, Y., Smith, G. L., Herrin, J., Masoudi, F. A., . . . Krumholz, H. M. (2003). Race, quality of care, and outcomes of elderly patients hospitalized with heart failure. *JAMA, 289*(19), 2517-2524. doi: 10.1001/jama.289.19.2517

Rathore, S. S., Masoudi, F. A., Wang, Y., Curtis, J. P., Foody, J. M., Havranek, E. P., & Krumholz, H. M. (2006). Socioeconomic status, treatment, and outcomes among elderly patients hospitalized with heart failure: findings from the National Heart Failure Project. *American Heart Journal, 152*(2), 371-378. doi: 10.1016/j.ahj.2005.12.002

Rodriguez-Artalejo, F., Guallar-Castillon, P., Herrera, M. C., Otero, C. M., Chiva, M. O., Ochoa, C. C., . . . Pascual, C. R. (2006). Social network as a predictor of hospital readmission and mortality among older patients with heart failure. *Journal of Cardiac Failure, 12*(8), 621-627. doi: 10.1016/j.cardfail.2006.06.471

Rodriguez-Artalejo, F., Guallar-Castillon, P., Pascual, C. R., Otero, C. M., Montes, A. O., Garcia, A. N., . . . Herrera, M. C. (2005). Health-related quality of life as a predictor of hospital readmission and death among patients with heart failure. *Archives of Internal Medicine, 165*(11), 1274-1279. doi: 10.1001/archinte.165.11.1274

Roe-Prior, P. (2007). Sociodemographic variables predicting poor post-discharge outcomes for hospitalized elders with heart failure. *MEDSURG Nursing, 16*(5), 317-321 315p.

Roger, V. L., Go, A. S., Lloyd-Jones, D. M., Benjamin, E. J., Berry, J. D., Borden, W. B., . . . Turner, M. B. (2012). Heart disease and stroke statistics-2012 update: A report from the American heart association. *Circulation, 125*(1), e2-e220.

Rosamond, W. P. F., Flegal, K. P., Furie, K. M. D., Go, A. M. D., Greenlund, K. P., Haase, N., . . . for the American Heart Association Statistics Committee and Stroke Statistics, S. (2008). Heart disease and stroke statistics-2008 update: a report from the american heart association statistics committee and stroke statistics subcommittee. *Circulation, 117*(4), e25-e146.

Ross, J. S., Chen, J., Lin, Z., Bueno, H., Curtis, J. P., Keenan, P. S., . . . Krumholz, H. M. (2010). Recent national trends in readmission rates after heart failure hospitalization. *Circulation: Heart Failure, 3*(1), 97-103. doi: 10.1161/circheartfailure.109.885210

Roy, C. (2008). *The Roy adaptation model*. Upper Saddle River, NJ: Pearson Prentice Hall.

Roy, C., & Andrews, H. A. (1999). *The Roy adaptation model*. Stamford, Conn.: Appleton & Lange.

Samarel, N., Tulman, L., & Fawcett, J. (2002). Effects of Two Types of Social Support and Education on Adaptation to Early-Stage Breast Cancer. *Research in nursing and health, 25*, 459-470.

Seo-Cho, J. M. (1999). *Nursing process manual: assessment tool for the Roy adaptation model*. Glendale, CA: Polaris Pub.

Setoguchi, S., & Stevenson, L. W. (2009). Hospitalizations in Patients with Heart Failure: Who and Why. *Journal of the American College of Cardiology, 54*(18), 1703-1705. doi: 10.1016/j.jacc.2009.08.015

Sheppard, R., Behlouli, H., Richard, H., & Pilote, L. (2005). Effect of gender on treatment, resource utilization, and outcomes in congestive heart failure in Quebec, Canada. *American Journal of Cardiology, 95*(8), 955-959. doi: 10.1016/j.amjcard.2004.12.033

Shinagawa, H., Inomata, T., Koitabashi, T., Nakano, H., Takeuchi, I., Naruke, T., . . . Izumi, T. (2008). Prognostic significance of increased serum bilirubin levels coincident with cardiac decompensation in chronic heart failure. *Circulation, 72*(3), 364-369.

Sliwa, K., Davison, B. A., Mayosi, B. M., Damasceno, A., Sani, M., Ogah, O. S., . . . Cotter, G. (2013). Readmission and death after an acute heart failure event: predictors and outcomes in sub-Saharan Africa: results from the THESUS-HF registry. *European Heart Journal, 34*(40), 3151-3159.

Song, E. K., Lennie, T. A., & Moser, D. K. (2009). Depressive symptoms increase risk of rehospitalisation in heart failure patients with preserved systolic function [corrected] [published erratum appears in J CLIN NURS 2009 Sep;18(8):2679]. *Journal of Clinical Nursing, 18*(13), 1871-1877. doi: 10.1111/j.1365-2702.2008.02722.x

Thavendiranathan, P., Yingchoncharoen, T., Grant, A., Seicean, S., Landers, S. H., Gorodeski, E. Z., & Marwick, T. H. (2013). Prediction of 30-Day Heart Failure-Specific Readmission Risk by Echocardiographic Parameters. *American Journal of Cardiology, 113*(2), 335-341. doi: 10.1016/j.amjcard.2013.09.025

Triposkiadis, F., Karayannis, G., Giamouzis, G., Skoularigis, J., Louridas, G., & Butler, J. (2009). The sympathetic nervous system in heart failure physiology, pathophysiology, and clinical implications. *Journal of the American College of Cardiology, 54*(19), 1747-1762. doi: 10.1016/j.jacc.2009.05.015

Tsai, P. F., Tak, S., Moore, C., & Palencia, I. (2003). Testing a theory of chronic pain. *Journal of Advanced Nursing, 43*(2), 158-169.

Tsuchihashi, M., Tsutsui, H., Kodama, K., Kasagi, F., Setoguchi, S., Mohr, M., . . . Takeshita, A. (2001). Medical and socioenvironmental predictors of hospital readmission in patients with congestive heart failure. *American Heart Journal, 142*(4), E7. doi: 10.1067/mhj.2001.117964

Tulman, L., Fawcett, J., & McEvoy, M. D. (1991). Development of the inventory of functional status-cancer. *Cancer Nursing Cancer Nursing, 14*(5), 254-260.

Vaccarino, V., Chen, Y. T., Wang, Y., Radford, M. J., & Krumholz, H. M. (1999). Sex differences in the clinical care and outcomes of congestive heart failure in the elderly. *American Heart Journal, 138*(5 Pt 1), 835-842.

Valle, R., Aspromonte, N., Carbonieri, E., D'Eri, A., Feola, M., Giovinazzo, P., . . . Milani, L. (2008). Fall in readmission rate for heart failure after implementation of B-type natriuretic peptide testing for discharge decision: a retrospective study. *International Journal of Cardiology, 126*(3), 400-406. doi: 10.1016/j.ijcard.2006.03.097

Valle, R., Aspromonte, N., Giovinazzo, P., Carbonieri, E., Chiatto, M., di Tano, G., . . . Milani, L. (2008). B-type natriuretic Peptide-guided treatment for predicting outcome in patients hospitalized in sub-intensive care unit with acute heart failure. *Journal of Cardiac Failure, 14*(3), 219-224. doi: 10.1016/j.cardfail.2007.10.009

Van der Wal, M. H., Jaarsma, T., Moser, D. K., Veeger, N. J., van Gilst, W. H., & van Veldhuisen, D. J. (2006). Compliance in heart failure patients: the importance of knowledge and beliefs. *European Heart Journal, 27*(4), 434-440.

Vasiliki, B., Patricia, M. D., Phillip, J. N., Steven, A. F., Peter, S. M., & Simon, S. (2010). What are the factors in risk prediction models for rehospitalisation for adults with chronic heart failure? *Australian Critical Care*. doi: 10.1016/j.aucc.2011.07.004

Verdiani, V., Ognibene, A., Rutili, M. S., Lombardo, C., Bacci, F., Terreni, A., & Nozzoli, C. (2008). NT-ProBNP reduction percentage during hospital stay predicts long-term mortality and readmission in heart failure patients. *Journal of Cardiovascular Medicine (Hagerstown), 9*(7), 694-699. doi: 10.2459/JCM.0b013e3282f447ae

Vinson, J. M., Rich, M. W., Sperry, J. C., Shah, A. S., & McNamara, T. (1990). Early readmission of elderly patients with congestive heart failure. *Journal of the American Geriatric Society, 38*(12), 1290-1295.

Vivo, R. P., Krim, S. R., Cevik, C., & Witteles, R. M. (2009). Heart failure in Hispanics. *Journal of the American College of Cardiology, 53*(14), 1167-1175. doi: 10.1016/j.jacc.2008.12.037

Volz, A., Schmid, J.-P., Zwahlen, M., Kohls, S., Saner, H., & Barth, J. (2011). Predictors of readmission and health related quality of life in patients with chronic heart failure: a comparison of different psychosocial aspects. *Journal of Behavioral Medicine, 34*(1), 13-22. doi: 10.1007/s10865-010-9282-8

Voorhis, C. V., & Morgan, B. L. (2007). Understanding power and rules of thumb for determining sample sizes. *Tutorials in Quantitative Methods for Psychology, 3*(2).

Watson, R. D. S., Gibbs, C. R., & Lip, G. Y. H. (2000). Clinical features and complications. *British Medical Journal, 320*(7229), 236-239.

Waweru, S. M., Reynolds, A., & Buckner, E. B. (2008). Perceptions of children with HIV/AIDS from the USA and Kenya: self-concept and emotional indicators. *Pediatric Nursing, 34*(2), 117-124.

Wettersten, N., Wilson, M., Tong, K., & López, J. E. (2014). Abstract 17063: Enhanced Prediction of Heart Failure 30-Day Readmission Risk With Four Readily-Available Clinical Variables. *Circulation, 130*(Suppl 2), A17063.

Wheeler, E. C., Klemm, P., Hardie, T., Plowfield, L., Birney, M., Polek, C., & Lynch, K. G. (2004). Racial disparities in hospitalized elderly patients with chronic heart failure. *Journal of Transcultural Nursing, 15*(4), 291-297. doi: 10.1177/1043659604268962

Whellan, D. J., Greiner, M. A., Schulman, K. A., & Curtis, L. H. (2010). Costs of inpatient care among Medicare beneficiaries with heart failure, 2001 to 2004. *Circulation. Cardiovascular quality and outcomes, 3*(1), 33-40.

Whittaker, B. D., Soine, L. A., & Errico, K. M. (2015). Patient and process factors associated with all-cause 30-day readmission among patients with heart failure. *JAAN Journal of the American Association of Nurse Practitioners, 27*(2), 105-113.

Whittemore, R., & Roy, S. C. (2002). Adapting to Diabetes Mellitus: A Theory Synthesis. *Nursing Science Quarterly, 15*(4), 311-317. doi: 10.1177/089431802236796

Yancy, C. W. (2000). Heart failure in african americans: a cardiovascular enigma. *Journal of Cardiac Failure, 6*(3), 183-186. doi: 10.1054/jcaf.2000.17610

Yancy, C. W., Jessup, M., Bozkurt, B., Butler, J., Casey, D. E., Drazner, M. H., . . . Wilkoff, B. L. (2013). 2013 ACCF/AHA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation, 128*(16), e240-e327. doi: 10.1161/CIR.0b013e31829e8776

Young, J. B., Abraham, W. T., Albert, N. M., Gattis Stough, W., Gheorghiade, M., Greenberg, B. H., . . . Fonarow, G. C. (2008). Relation of low hemoglobin and anemia to morbidity and mortality in patients hospitalized with heart failure (insight from the OPTIMIZE-HF registry). *American Journal of Cardiology, 101*(2), 223-230. doi: 10.1016/j.amjcard.2007.07.067

Zeigler, L., Smith, P. A., & Fawcett, J. (2004). Breast cancer: evaluation of the Common Journey Breast Cancer Support Group. *Journal of Clinical Nursing, 13*(4), 467-478. doi: 10.1046/j.1365-2702.2003.00893.x

## APPENDIX A

## THE HEART FAILURE DATA COLLECTION TOOL

| | |
|---|---|
| Patient's code (code) | |
| Rehospitalized/Not rehospitalized | 1. Rehospitalized<br>2. Not rehospitalized |
| Age (age) | _____ Years |
| | |
| Gender (gender) | 1)Male 2) Female |
| Race (race) | 1. White<br>2. Black<br>3. Hispanic<br>4. Asian<br>5. Native American<br>6. Others_____ |
| Length of stay (LOS) | _____day (s) first admission |
| Zip code (Zip) (Rural/Urban) | _____ |
| Marital status (Marit_stat) | 1. Single<br>2. Married<br>3. Divorced<br>4. Widowed |
| BMI(BMI) | _____ |
| Number of Previous HF hospitalization (Pre_hosp) | _____# past three years |
| Lives alone (alone) | 1)Yes 2) NO |
| Difference between weight on discharge and weight on admission (wt_diff) (calculated) | _____ kg |
| The diagnosis of Diabetes (DM) | 1)Yes 2) NO |
| The diagnosis of Hypertension(HTN) | 1)Yes 2) NO |
| The diagnosis of Atrial fibrillation(A_Fib) | 1)Yes 2) NO |
| The diagnosis of Coronary artery disease (CAD) | 1)Yes 2) NO |
| The diagnosis of Myocardial infarction (MI) | 1)Yes 2) NO |
| The diagnosis of Angina pectoris (angina) | 1)Yes 2) NO |
| The diagnosis of Stroke (stroke) | 1)Yes 2) NO |
| The diagnosis of Anemia (anemia) | 1)Yes 2) NO |
| The diagnosis of Hyponatremia (hyponat) | 1)Yes 2) NO |
| The diagnosis of Hypokalemia (hypoKal) | 1)Yes 2) NO |
| The diagnosis of Chronic kidney disease (kidney_dis), | 1)Yes 2) NO |

| | |
|---|---|
| The diagnosis of Chronic obstructive pulmonary disease (COPD) | 1)Yes 2) NO |
| The diagnosis of Obstructive Sleep Apnea (OSA) | 1)Yes 2) NO |
| The diagnosis of Depression (depression) | 1)Yes 2) NO |
| The diagnosis of Anxiety (anxiety) | 1)Yes 2) NO |
| The use of CPAP (CPAP) | 1)Yes 2) NO |
| New York Heart Association for HF classification (HF_class) | 1. Class I<br>2. Class II<br>3. Class III<br>4. Class IV |
| Ejection fraction (EF) | _____ |
| The level of Hemoglobin on admission (Hb_ad) | _____ g/dl |
| The level of Hemoglobin at discharge (Hb_dc) | _____ g/dl |
| The level of Hematocrit on admission (Hct_ad) | _____ % |
| The level of Hematocrit at discharge (Hct_dc) | _____ % |
| The level of sodium on admission (Na_ad) | _____ mEq/L |
| The level of sodium at discharge (Na_dc) | _____ mEq/L |
| The level of potassium on admission (K_ad) | _____ mEq/L |
| The level of potassium at discharge (K_dc) | _____ mEq/L |
| The level of hemoglobin A1c (HbA1c) | _____ % |
| The level of creatinine on admission (Cr_ad) | _____mg/dl |
| The level of creatinine at discharge (Cr_dc) | _____mg/dl |
| The level of total bilirubin on admission (bil_ad) | _____mg/dl |
| The level of total bilirubin at discharge (bil_dc) | _____mg/dl |
| The level of blood urea nitrogen on admission (BUN_ad) | _____mg/dl |
| The level of blood urea nitrogen at discharge (BUN_dc) | _____mg/dl |
| The level of uric acid on admission (uric_acid_ad) | _____mg/dl |
| The level of uric acid at discharge (uric_acid_dc) | _____mg/dl |
| The level of B-type natriuretic peptide (BNP) | _____pg/mL |
| The level of C-reactive protein (CRP) | _____mg/l |
| The level of cardiac Troponin I (Troponin_I) | Troponin I:_____ µg/L |
| The level of cardiac Troponin T (Troponin_T) | Troponin T:_____ µg/L |
| The use of loop diuretics (loop_diur) | 2) No 1) Yes:<br>_____ |
| The use of Thiazides (HCTZ) | 2) No 1) Yes:<br>_____ |
| The use of potassium-sparing diuretics (spironolactone) | 2) No 1) Yes:<br>_____ |

| | |
|---|---|
| The use of Beta-Blocker (BB) | 2) No 1) Yes: _____ |
| The use of Angiotensin Converting Enzymes inhibitor (ACE) | 2) No 1) Yes: _____ |
| The use of Angiotensin II Receptor Blockers (ARB) | 2) No 1) Yes: _____ |
| The use of antidepressants | 2) No 1) Yes: _____ |
| The use of anxiolytics | 2) No 1) Yes: _____ |
| Insurance status (insured) | 2) No 1) Yes: Insurer :_____ |
| Employment status (employ) | 2)No 1)Yes_____ |

## APPENDIX B

## LIST OF VARIABLES

| Variable (code) | Measurement | ICD-9 code |
|---|---|---|
| Contextual factors | | |
| Age (age) | Continues | N/A |
| Gender (gender) | Categorical | N/A |
| Race (race) | Categorical | N/A |
| Length of stay (LOS) | Continues | N/A |
| Zip code (Zip) (Rural/Urban) | N/A | N/A |
| Previous HF hospitalization (Pre_hosp) | Categorical | N/A |
| New York Heart Association for HF classification (HF_class) | Categorical | N/A |
| Physiologic-physical factors | | |
| The diagnosis of Diabetes (DM) | Categorical | 249.00 |
| The diagnosis of Hypertension(HTN) | Categorical | 401.9 |
| The diagnosis of Atrial fibrillation(AF) | Categorical | 427.31 |
| The diagnosis of Myocardial infarction (MI) | Categorical | 410.00 |
| The diagnosis of Angina pectoris (angina) | Categorical | 413.9 |
| The diagnosis of Stroke (stroke) | Categorical | V17.1 |
| The diagnosis of Anemia (anemia) | Categorical | 280.0 |
| The diagnosis of Hyponatremia (hyponat) | Categorical | 276.1 |
| The diagnosis of Chronic kidney disease (kidney_dis) | Categorical | 585.1 |
| The diagnosis of Chronic obstructive pulmonary disease (COPD) | Categorical | 490-492, 494, 496 |
| Ejection fraction (EF) | Continues | N/A |
| The use of CPAP (CPAP) | Categorical | N/A |
| The diagnosis of Obstructive Sleep Apnea (OSA) | Categorical | 327.23 |
| The level of hemoglobin on admission (Hb_ad) | Continues | N/A |
| The level of hemoglobin at discharge (Hb_dc) | Continues | N/A |
| The level of hematocrit on admission (Hct_ad) | Continues | N/A |
| The level of hematocrit at discharge (Hct_dc) | Continues | N/A |
| The level of sodium on admission (level_Na_ad) | Continues | N/A |
| The level of sodium at discharge (level_Na_dc) | Continues | N/A |
| The level of potassium on admission (level_K) | Continues | N/A |
| The level of potassium at discharge (K_dc) | Continues | N/A |

| | | |
|---|---|---|
| The level of hemoglobin A1c (HbA1c) | Continues | N/A |
| The level of creatinine on admission (Cr_ad) | Continues | N/A |
| The level of creatinine at discharge (Cr_dc) | Continues | N/A |
| The level of total bilirubin on admission (bil_ad) | Continues | N/A |
| The level of total bilirubin at discharge (bil_dc) | Continues | N/A |
| The level of blood urea nitrogen on admission (BUN_ad) | Continues | N/A |
| The level of blood urea nitrogen at discharge (BUN_dc) | Continues | N/A |
| The level of uric acid on admission (uric_acid_ad) | Continues | N/A |
| The level of uric acid at discharge (uric_acid_dc) | Continues | N/A |
| The level of B-type natriuretic peptide (BNP) | Continues | N/A |
| The level of cardiac troponin (troponin) | Continues | N/A |
| The use of Loop diuretics (loop_diur), | Categorical | N/A |
| The use of Thiazides (HCTZ) | Categorical | N/A |
| The use of Potassium-sparing diuretics (spironolactone) | Categorical | N/A |
| The use of Beta-Blocker (BB) | Categorical | N/A |
| The use of Angiotensin Converting Enzymes inhibitor (ACE_inhibitor) | Categorical | N/A |
| The use of Angiotensin II Receptor Blockers (ARB) | Categorical | N/A |
| Self-concept mode factors | | |
| The diagnosis of Depression (depression) | Categorical | V79.0 |
| The diagnosis of Anxiety | Categorical | 300.02 |
| The use of Antidepressants | Categorical | N/A |
| The use of Anxiolytics | Categorical | N/A |
| Role function mode factors | | |
| Insurance status (insured) | Categorical | N/A |
| Employment status (employ) | Categorical | N/A |
| Living situation (Alone) | Categorical | N/A |
| Marital status (married) | Categorical | N/A |